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HOSPITAL BUILDING NOTE

DIAGNOSTIC X-RAY DEPARTMENT

6

Department of Health and Social Security: London

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Hospital Building Note Number 6

Diagnostic X-Ray Department

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Appendix

Building Notes recommend the standards of accommodation and services for hospital departments which the Ministry of Health considers it reasonable to provide. Each Building Note contains a Cost Note from which may be derived a Departmental Cost Allowance appropriate to the department. Hospital Boards are at liberty to depart from the design recommendations given in Building Notes provided that they are satisfied that the standards of accommodation and services they adopt are adequate. The Departmental Cost Allowance, however, is to be regarded as the maximum sum of money available for the department and it should not be exceeded. Hospital Boards are encouraged to produce designs for the provision of appropriate accommodation and services at a cost less than the Departmental Cost Allowance.

An addendum to Appendix E of Hospital Building Note No. 2, *The Cost of Hospital Buildings*, which sets out cost recommendations for Diagnostic X-ray Department is supplied with this Building Note.

I. Scope

1. This revised Building Note gives guidance on the design of radiological departments where the normal radiological techniques common to both general and teaching hospitals are used. A large number of departments will require between 4 and 8 diagnostic rooms and these sizes are defined in detail; 2 and 3 room departments would be considered exceptional and only built with a view to ultimate enlargement to 4 rooms and above. Larger departments (above 8 diagnostic rooms) are dealt with in more general terms as they generate planning problems which require individual solutions.

II. General considerations

2. Diagnostic radiological procedures involve the use of x-rays which have great penetrating power, and can harm living cells when absorbed in excess. This Building Note should, therefore, be read in conjunction with the *Code of Practice for the Protection of Persons against Ionising Radiations arising from Medical and Dental Use*.* It is important that authoritative advice about the suitability of the location, design and construction of the premises and equipment should be obtained at an early stage of planning, either from a hospital physicist or the Radiological Protection Service, Clifton Avenue, Belmont, Sutton, Surrey, which is available to provide advice routinely or on unusual installations.

3. This present Building Note is concerned solely with diagnostic radiology. Except where both diagnostic radiology and radiotherapy departments have from long usage grown up side by side in the same hospital, they are not normally housed together. The planning of a radiotherapy department will be dealt with in a Building Note to be published later.

Siting

4. The radiological department is an entity in itself. It serves the whole hospital: in-patient, out-patient and accident and emergency departments.

5. A high proportion of out-patients require a visit to the diagnostic radiology department and to ensure that patients' and staff time is not wasted this department should be close to the consultative out-patient department. It should also be adjacent to the accident and emergency department if x-ray facilities are not provided in that department and it should also be within easy access of the wards.

Layout and circulation

6. The circulation of patients, staff and films within the department must be closely integrated and their routes must be arranged within a compact area. This is essential to allow complete internal administrative control as well as to allow the siting of a complex department at a focal point within the hospital.

7. The patient may come direct to the department at the request of his general practitioner for a simple diagnostic procedure, such as an x-ray examination of a fractured wrist, or he may come from the accident and emergency department, or be sent by one of the hospital medical staff from the out-patient or in-patient departments.

8. He may arrive on foot, in a wheelchair, or on a stretcher, at the reception point to the department where his particulars are recorded and from where he can be directed to an x-ray room. Although patients attending a hospital will register at the hospital registration office or counter, a register of all those who attend the x-ray department is kept in that department.

9. Figure 1 illustrates routes for all patients in the department undergoing x-ray examination.

10. At the examination previous x-rays, whether taken at that hospital or elsewhere, and the reports on them should be available whenever possible so that unnecessary x-rays can be avoided and the radiation dose kept to a minimum. Figure 2 illustrates the route for x-ray films during diagnostic investigations.

11. The following staff are employed in the department:

(*a*) non-technical, such as clerks and records officers, porters, etc.;

(*b*) technical, such as radiographers and darkroom staff;

(*c*) medical, including radiologists and others who attend to assist in more complicated examinations.

12. The passage of equipment and/or beds should be allowed for in the design of doors.

13. Offices and consulting rooms should be provided with good natural lighting and ventilation wherever possible. Departments with rooms which are wholly artificially lit and ventilated should be sited so that the staff employed in them have easy access to circulation and other areas with natural lighting and ventilation.

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* *Code of Practice for the Protection of Persons exposed to Ionising Radiations arising from Medical and Dental Use*, published by H.M. Stationery Office; price 12s. 6d.

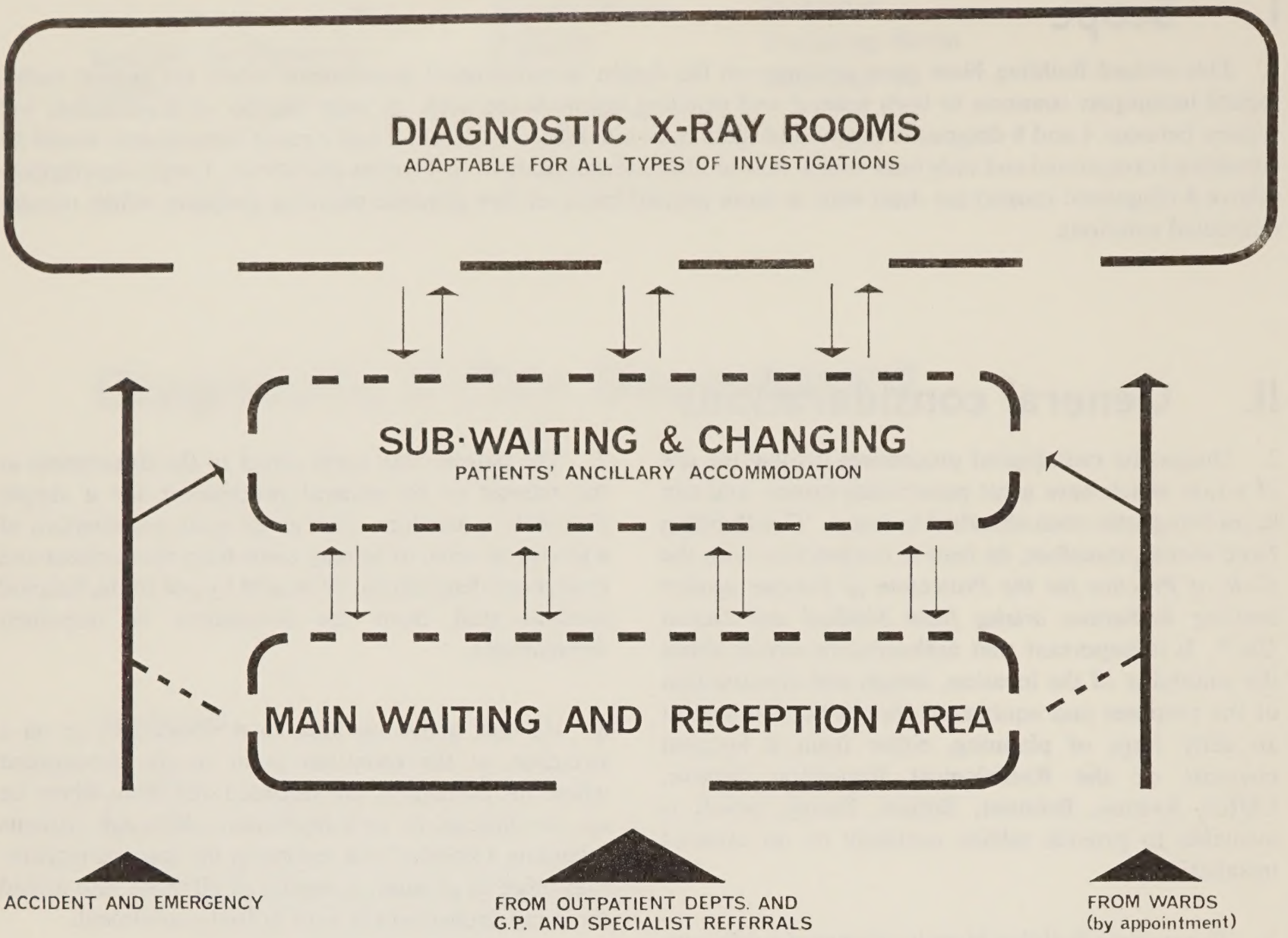
DIAGNOSTIC X-RAY ROOMS
ADAPTABLE FOR ALL TYPES OF INVESTIGATIONS
SUB·WAITING & CHANGING
PATIENTS' ANCILLARY ACCOMMODATION
MAIN WAITING AND RECEPTION AREA
ACCIDENT AND EMERGENCY
FROM OUTPATIENT DEPTS. AND G.P. AND SPECIALIST REFERRALS
FROM WARDS (by appointment)

FIGURE 1. Diagram showing patient circulation.

patient's previous films and records are made available to the radiologist before each re·examination and again when reporting on the re·examination.

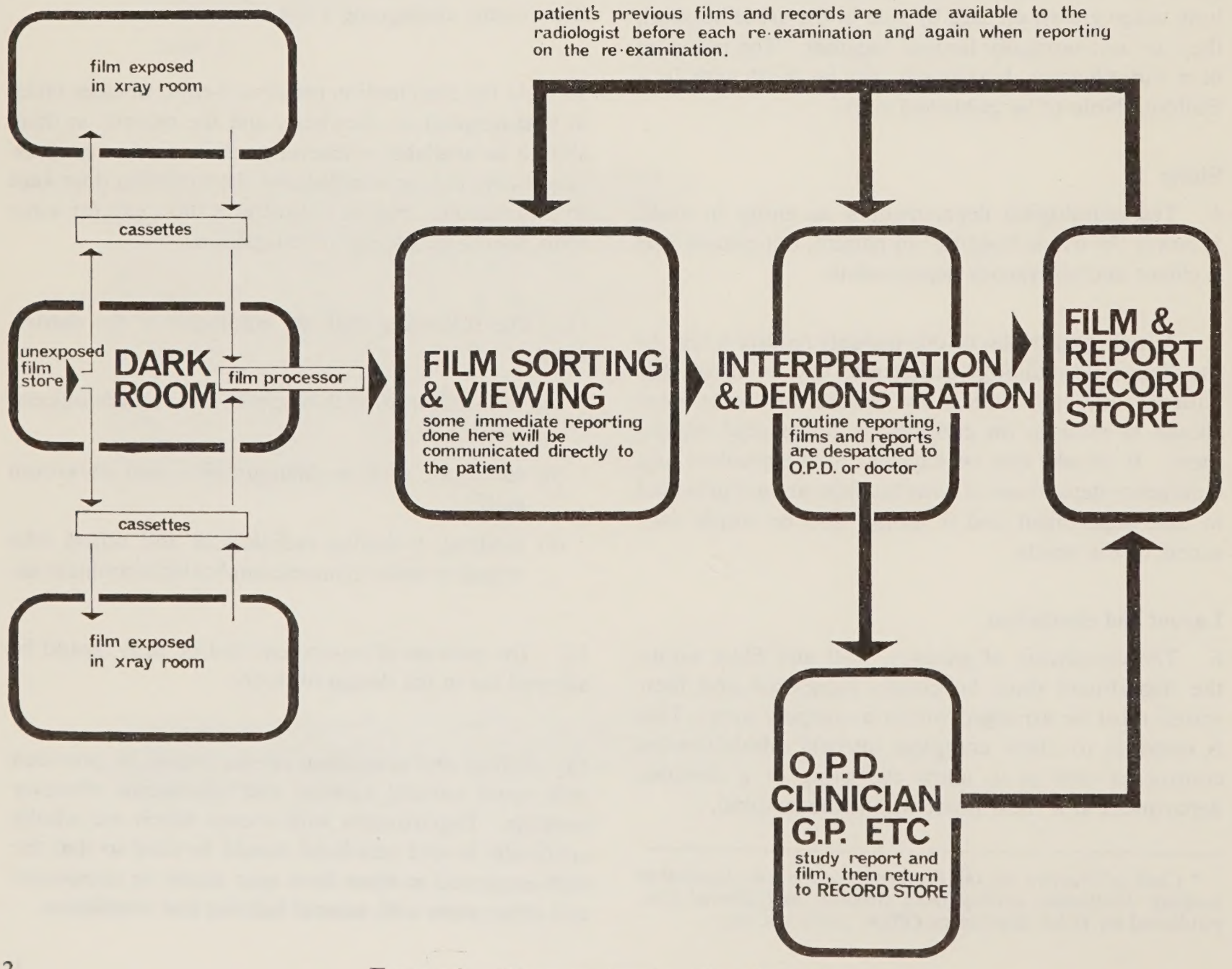
film exposed in xray room
cassettes
unexposed film store
DARK ROOM
film processor
cassettes
film exposed in xray room
FILM SORTING & VIEWING
some immediate reporting done here will be communicated directly to the patient
INTERPRETATION & DEMONSTRATION
routine reporting, films and reports are despatched to O.P.D. or doctor
FILM & REPORT RECORD STORE
O.P.D. CLINICIAN G.P. ETC
study report and film, then return to RECORD STORE

FIGURE 2. Diagram showing film circulation.

Various patterns of development

14. There are four easily recognisable patterns of layout for x-ray departments:

(*a*) the cluster plan;
(*b*) the linear plan; } for small departments

(*c*) the sandwich plan—for large departments (min. 6 rooms);

(*d*) multiple cluster plans—for large departments (min. 8 rooms).

(*a*) *The cluster plan*

15. This has been developed to suit the small intensively used department and can be expected to be more efficient and economical to run than the linear type of layout (see Figure 3). The radiographer will be close to the darkroom and viewing area which forms the nucleus of the cluster. Because of the centralisation of film processing the percentage of circulation area for a peripheral corridor is rather high. This can reach an uneconomic proportion in large cluster plans (8 rooms) if the only access to the department is from one side, requiring beds and stretchers to be wheeled through it. Figure 4 illustrates a 6-room cluster plan with access from one side only. (This is the worst condition for a cluster plan and requires extensive circulation space.) Figure 5 shows an 8-room plan where in-patients (on stretchers) can enter from the side opposite to the main out-patient entrance, thus saving on lengths and widths of internal corridors.

(*b*) *The linear plan*

16. The *linear plan* is adaptable in that it can be made to fit a central corridor shape, and external wall condition, which may have been chosen to suit other departments on other floors. A central corridor is adequate for all normal forms of traffic (patients, staff, equipment) generated within a small (4-room) department. At 6 rooms the corridor becomes very heavily used, while at 8 rooms it becomes overloaded and liable to cause congestion. In this situation it is preferable to split the department into two parts, one above the other, with staircases and hoists for internal communications. Figure 6 illustrates a linear type of plan, which normally has the diagnostic and processing rooms on one side, and the ancillary rooms on the other side of a single central corridor. In order to reduce their length linear plans should, if possible, have sufficient width to plan diagnostic rooms as well as ancillaries on *both* sides of the corridor, as shown in Figure 7. If this is not possible, departments with more than 4 rooms become elongated and require more than one darkroom, each linked to the x-ray rooms by mechanical conveyors. The 4-room linear plan shown in Figure 7 has circulation space comparable with the 4-room cluster plan but the latter is more suitable for intensive use of rooms.

(*c*) *The sandwich plan*

17. From about 6 rooms upwards, the quantity of traffic generated by sub-sections of the department is sufficient to plan separate circulation zones for patients and staff. The sandwich plan provides patient circulation and ancillaries on one side of a bank of diagnostic rooms, with staff circulation, processing and ancillaries on the other side. Figure 8 illustrates a sandwich plan. With large departments there must, in any case, be reliance on mechanical conveyors and electronic communications and, when these are inevitable, a large variety of patterns becomes possible. Figure 9 shows a double banked pattern suitable for large departments.

(*d*) *Multiple cluster plans*

18. The central bank of the sandwich may consist of a single line of rooms or of a line of 4-room clusters (see Figure 10); the latter arrangement has some advantages in reducing the overall length and in allowing individual clusters to operate independently of each other or of the central processing area.

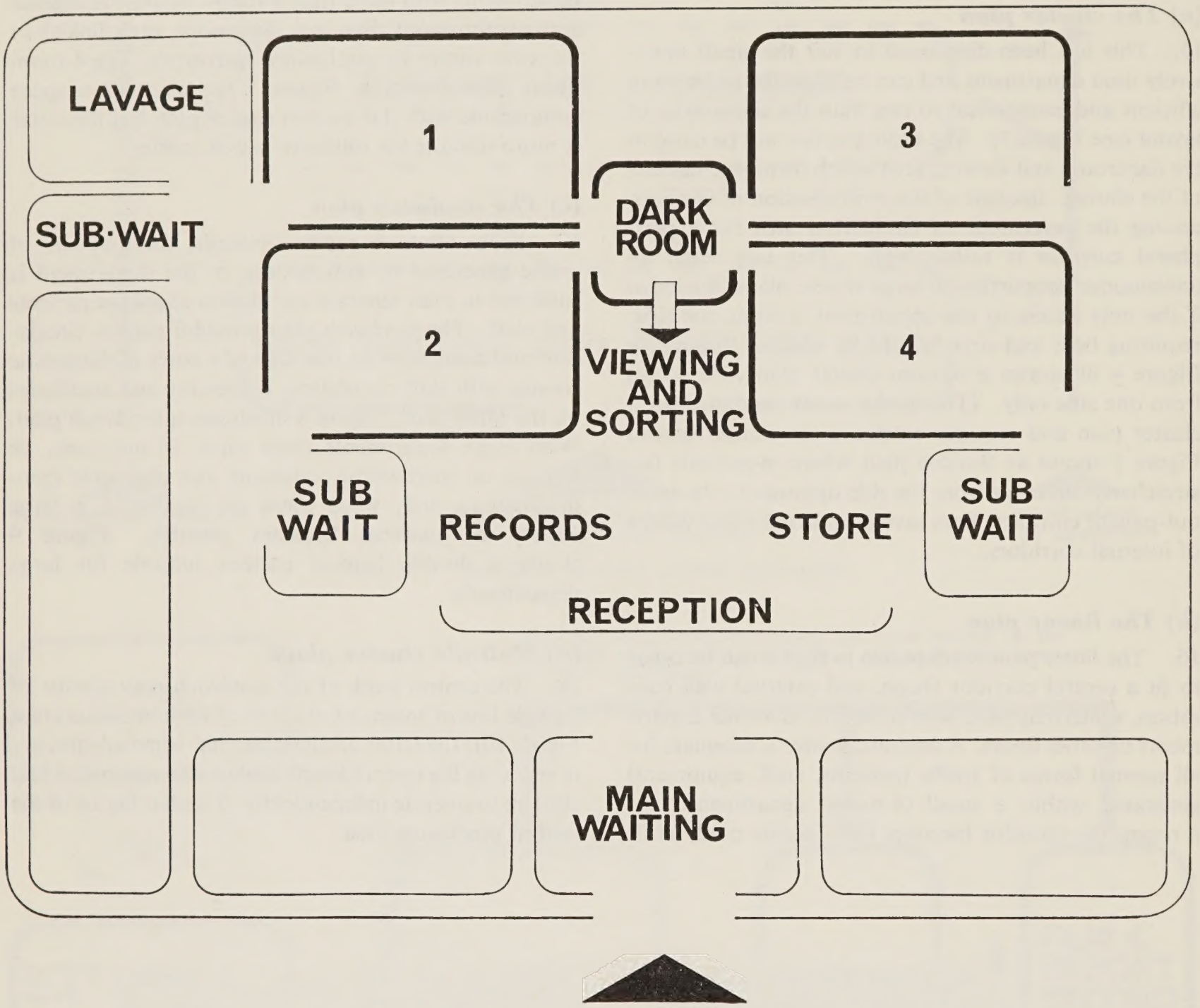

FIGURE 3. Cluster plan for a 4-roomed department

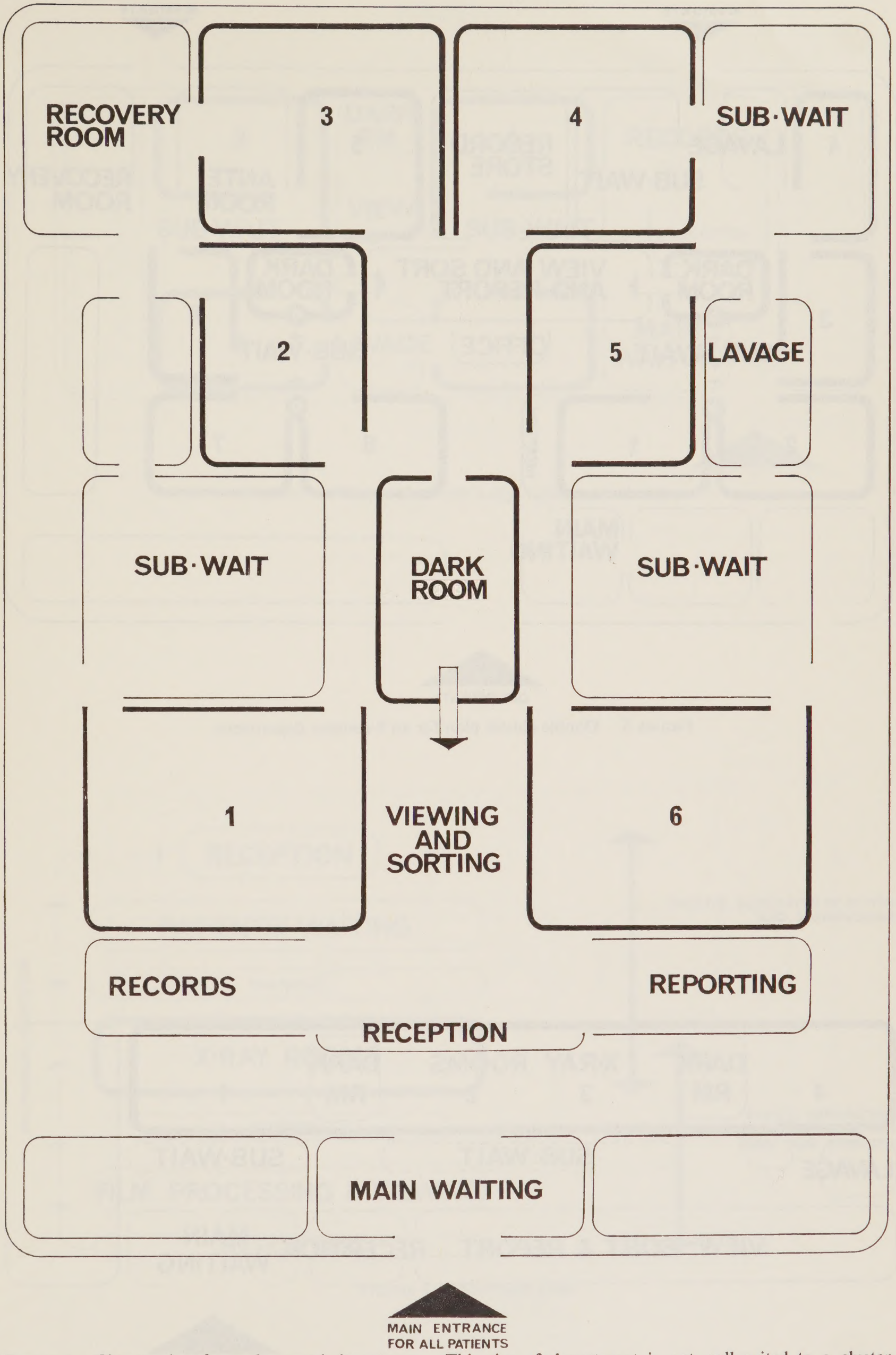

FIGURE 4. Cluster plan for a 6-roomed department. This size of department is not well suited to a cluster pattern if in-patients have to enter on the same side as out-patients.

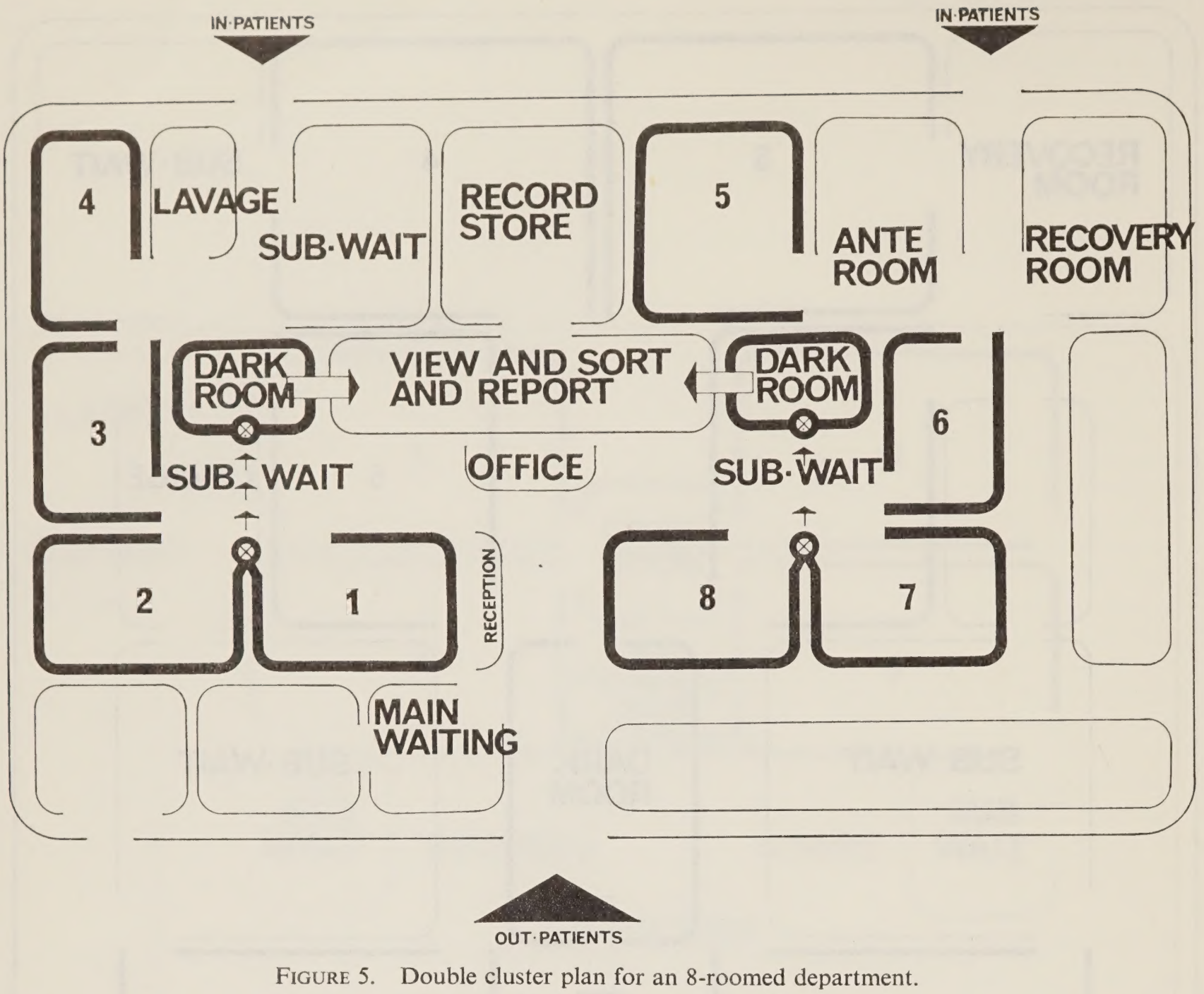

FIGURE 5. Double cluster plan for an 8-roomed department.

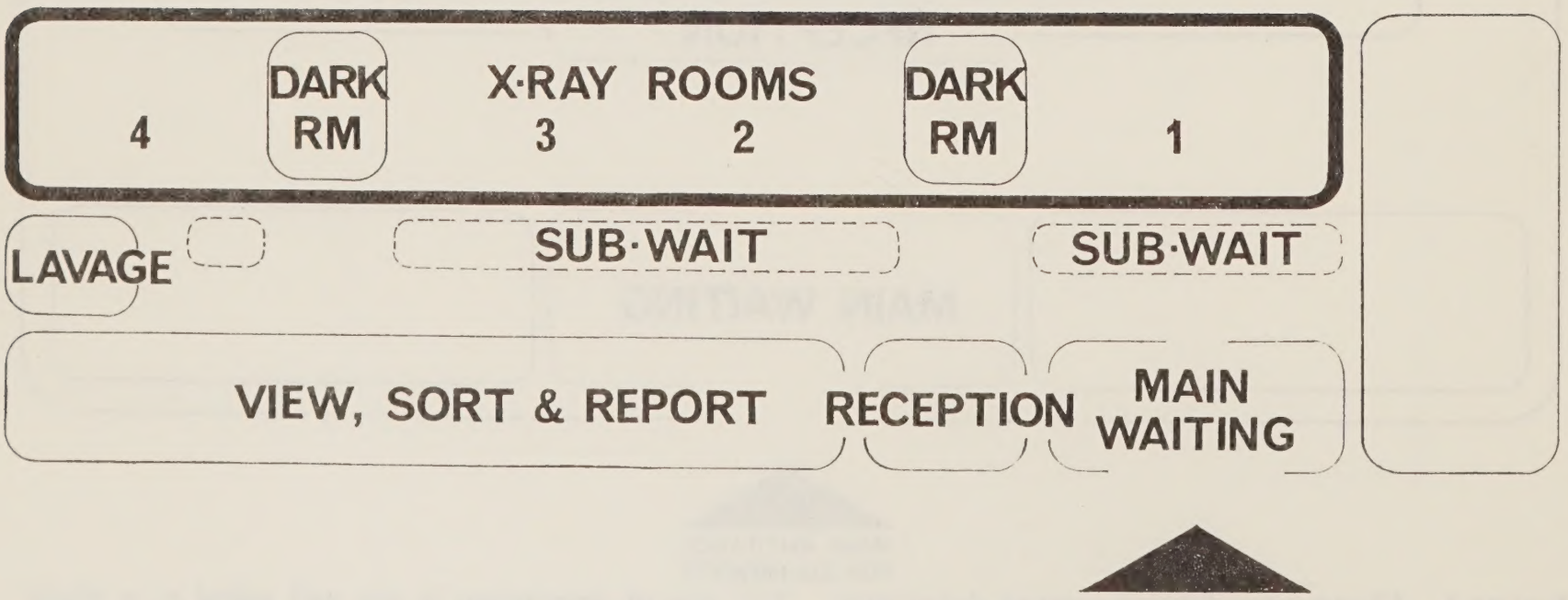

FIGURE 6. Linear plan with x-ray rooms on one side only.

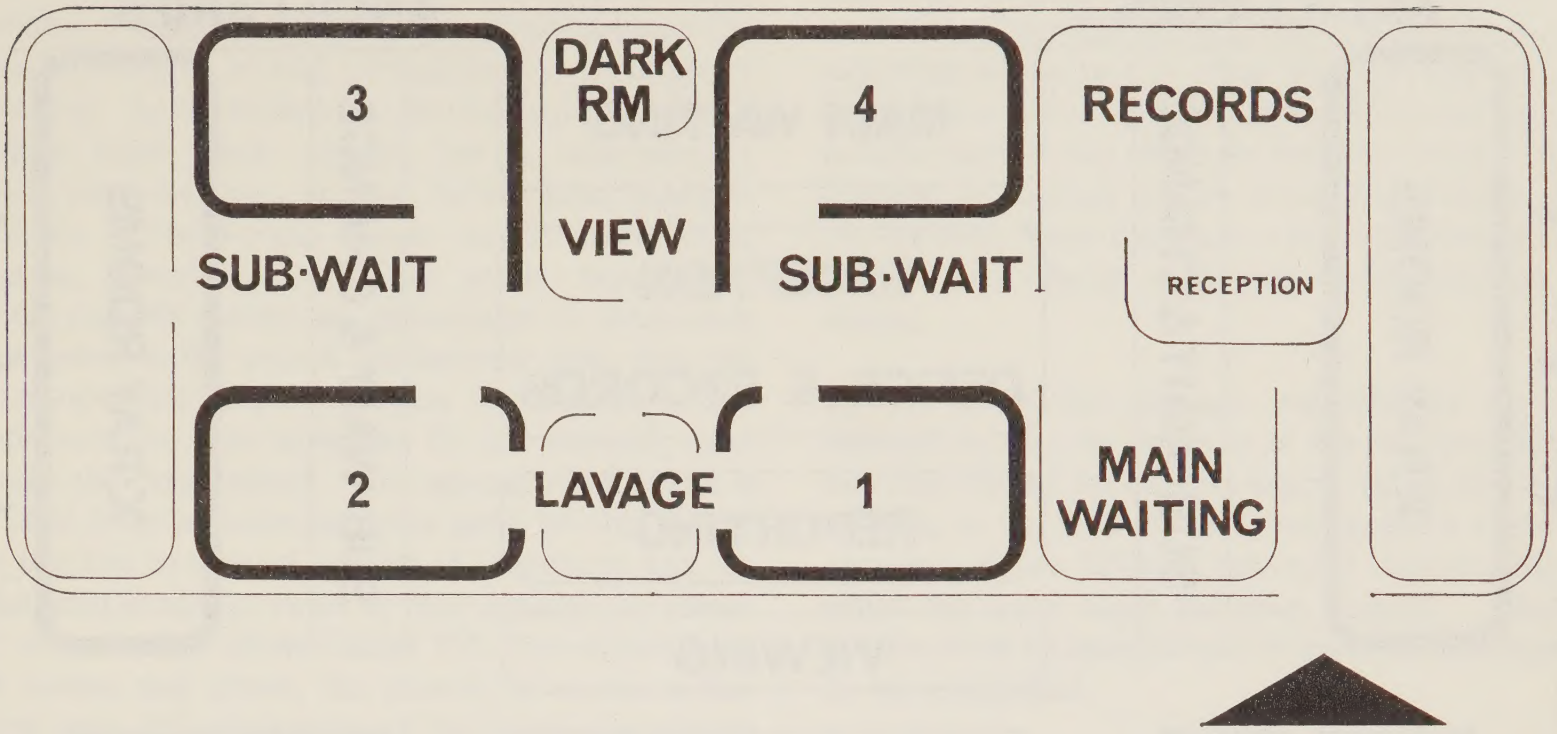

FIGURE 7. Linear plan with x-ray rooms on both sides.

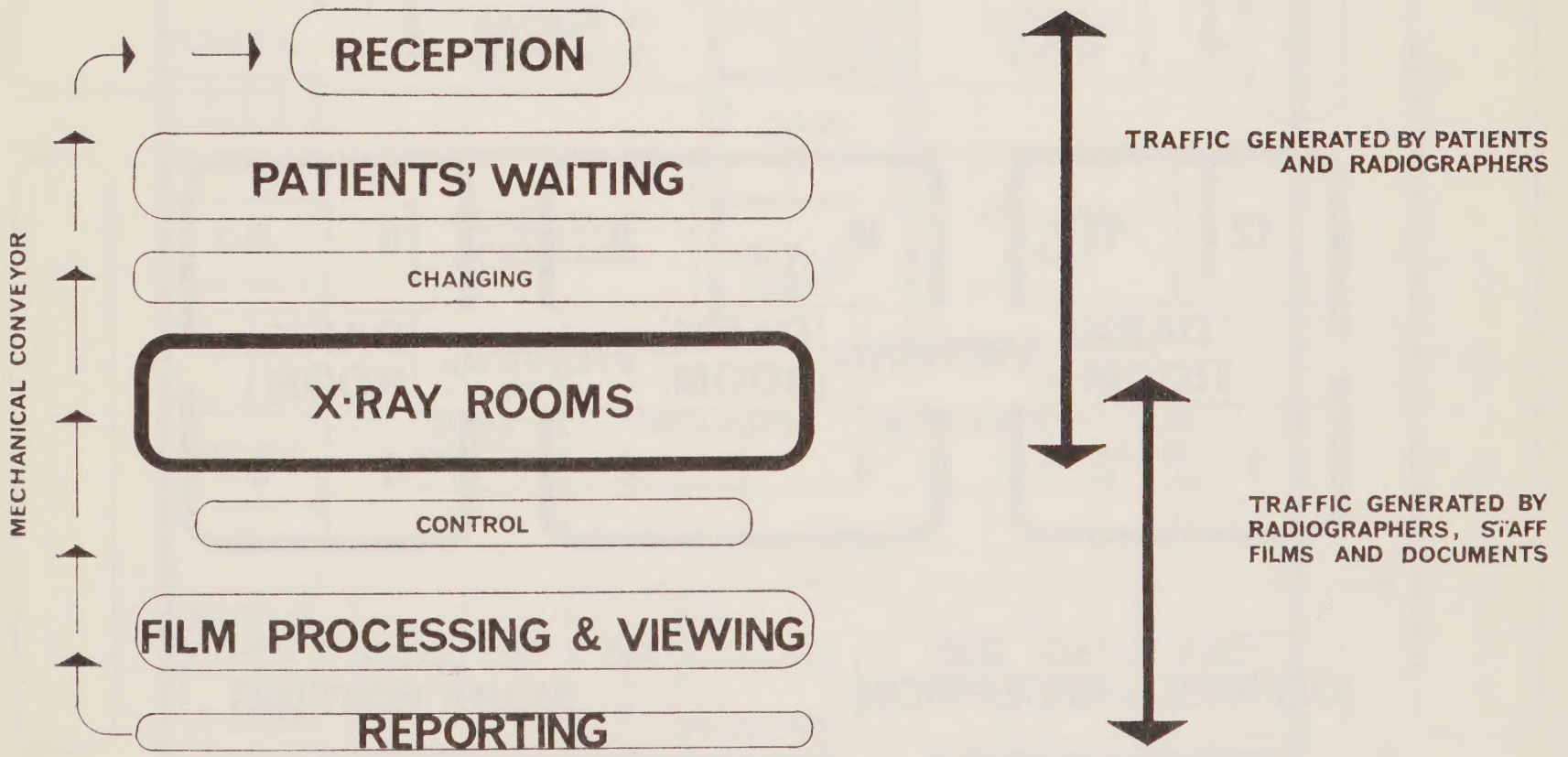

FIGURE 8. Sandwich plan.

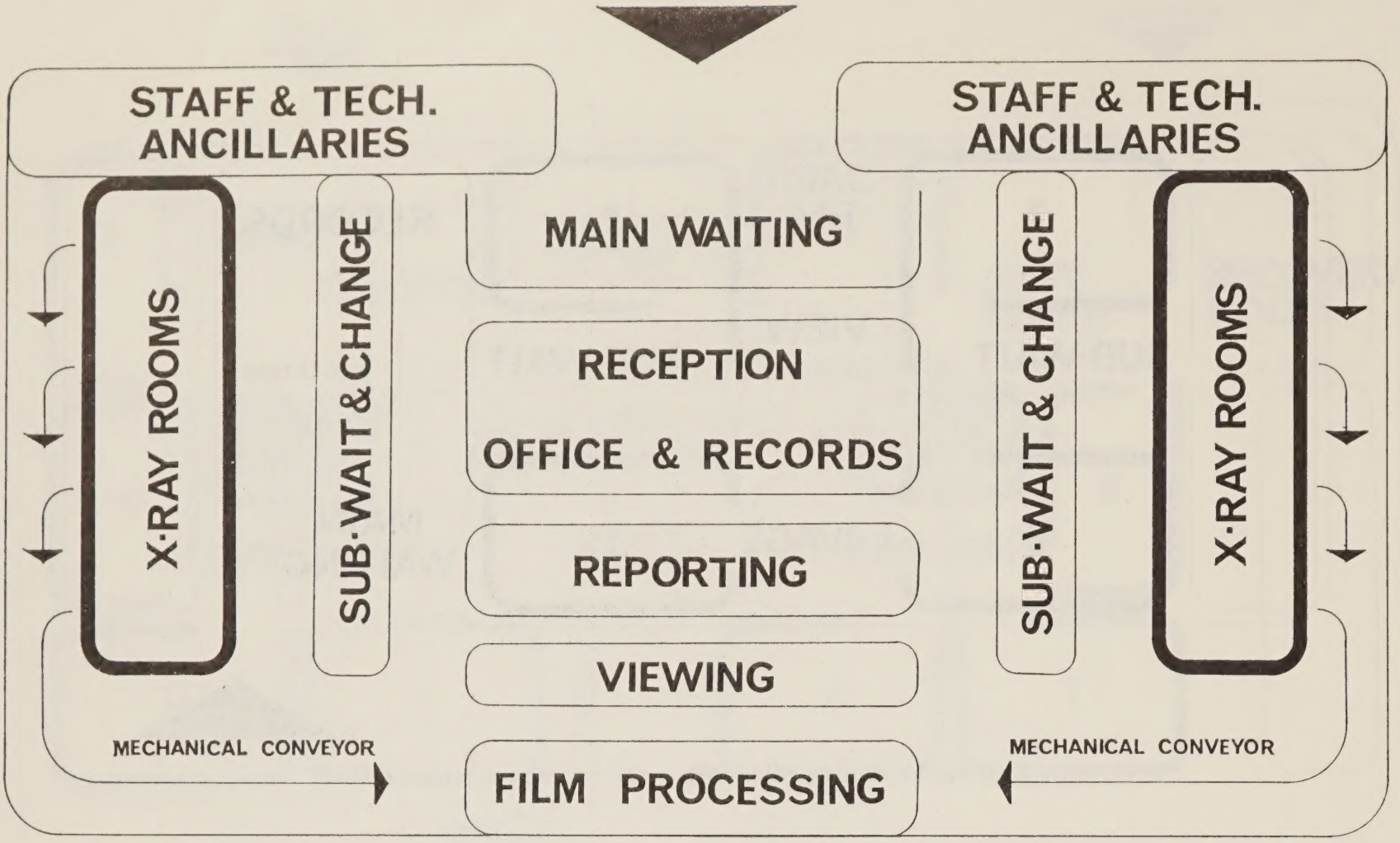

FIGURE 9. Double-banked plan.

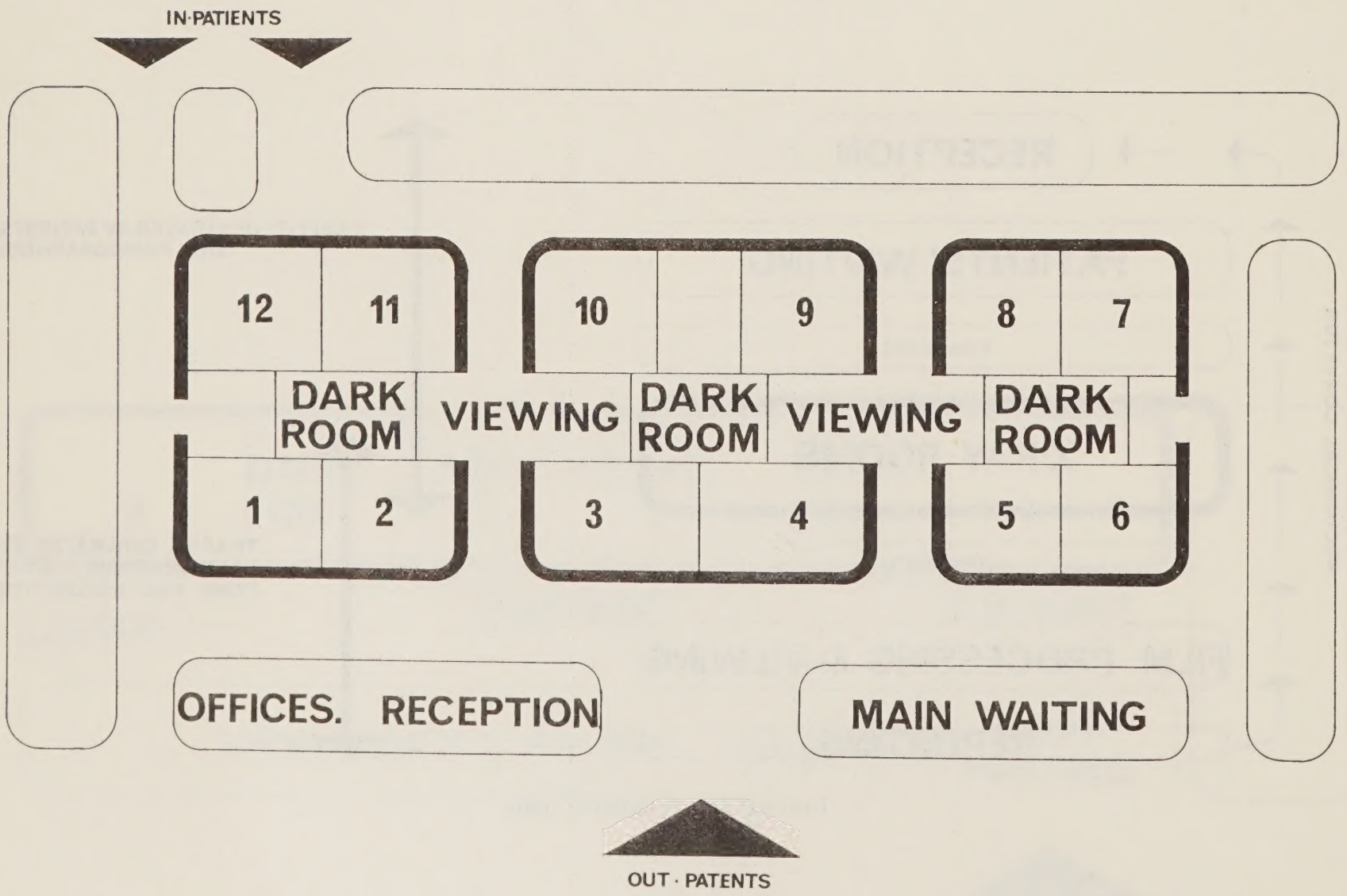

FIGURE 10. Multiple cluster plan.

Conclusions

19. In choosing a suitable layout pattern, the long term as well as the immediate advantages must be considered. For small (4-room) departments the linear plan is cheap, adaptable to other building forms, and easily extendable either horizontally or with vertical links to an upper or lower floor. An equivalent 4-room cluster plan probably occupies more space initially, but is adaptable to absorb large increases in load before extra room is necessary. The 4-room cluster can be extended to 6 rooms, though not as simply as the linear plan. Cluster plans (8 rooms) are extravagant of circulation space unless in the overall development plan they can be arranged with separate access for in-patients and out-patients (so that stretchers do not normally pass through the department). This separation of access is not ideal from an administrative point of view unless care is taken to control arrivals of in-patients and the receptionist is always aware of their presence by means of " intercom " or closed circuit TV. For departments of 8 rooms and above, the pattern of rooms is less critical than the relationship of the whole department to other hospital activities. This is because many of the circulation problems (of films, etc.) have to be solved by automation and traffic of personnel can to some extent be sub-divided into special zones for particular groups such as for staff, in-patients and out-patients. Figures 11, 12 and 13 are example layouts developed from the principles explained above.

Radiological techniques

20. The principles of radiological techniques are as follows: X-rays are generated by passing a current of electricity through a filament (the cathode) which lies in a high voltage field varying from 40 to 150 kilovolts, according to the type of x-ray tube and the particular examination which is taking place. Electrons travelling at high speed in this field pass from the heated cathode filament to impinge on the anode from which x-rays are emitted. These rays have a high penetrating power and can pass through many substances including body tissues.

21. Some, in their passage, are deflected and some changed so that the intensity of the emergent beam is less than that of the incident beam. By placing a sensitive film in the path of the emergent beam a record is obtained of the different structural densities through which the x-ray beam has been directed. When the film has been processed it can be viewed and interpreted by the radiologist.

22. The rays which produce the film image are known as the useful beam. All other rays must be contained and finally absorbed by suitable material. The film used in radiology differs from that for most photographic processes in that it consists of a base coated on both sides by emulsion sensitive to light and to x-rays. When x-rays impinge on a suitable material it becomes

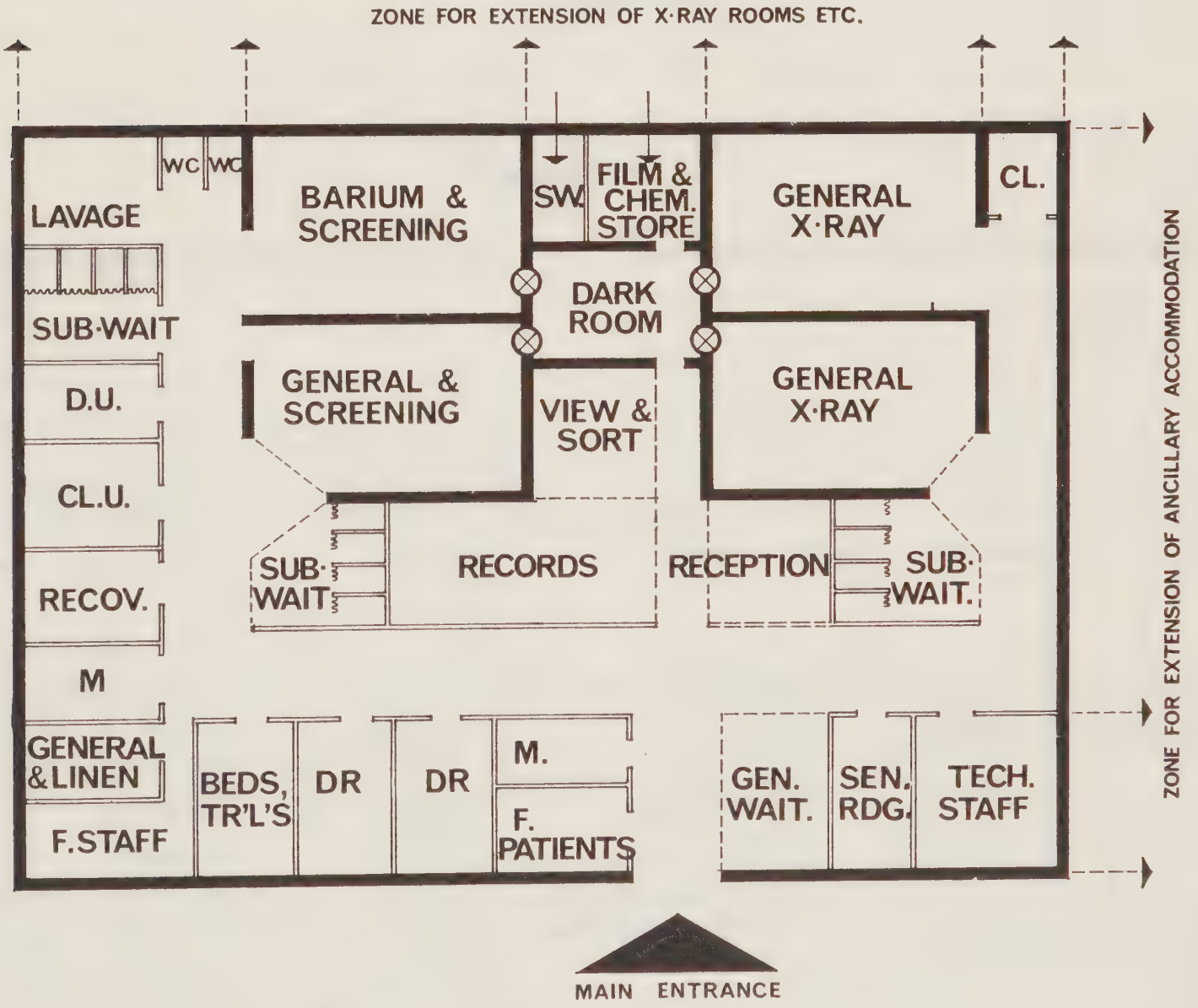

FIGURE 11. Four-roomed x-ray department.

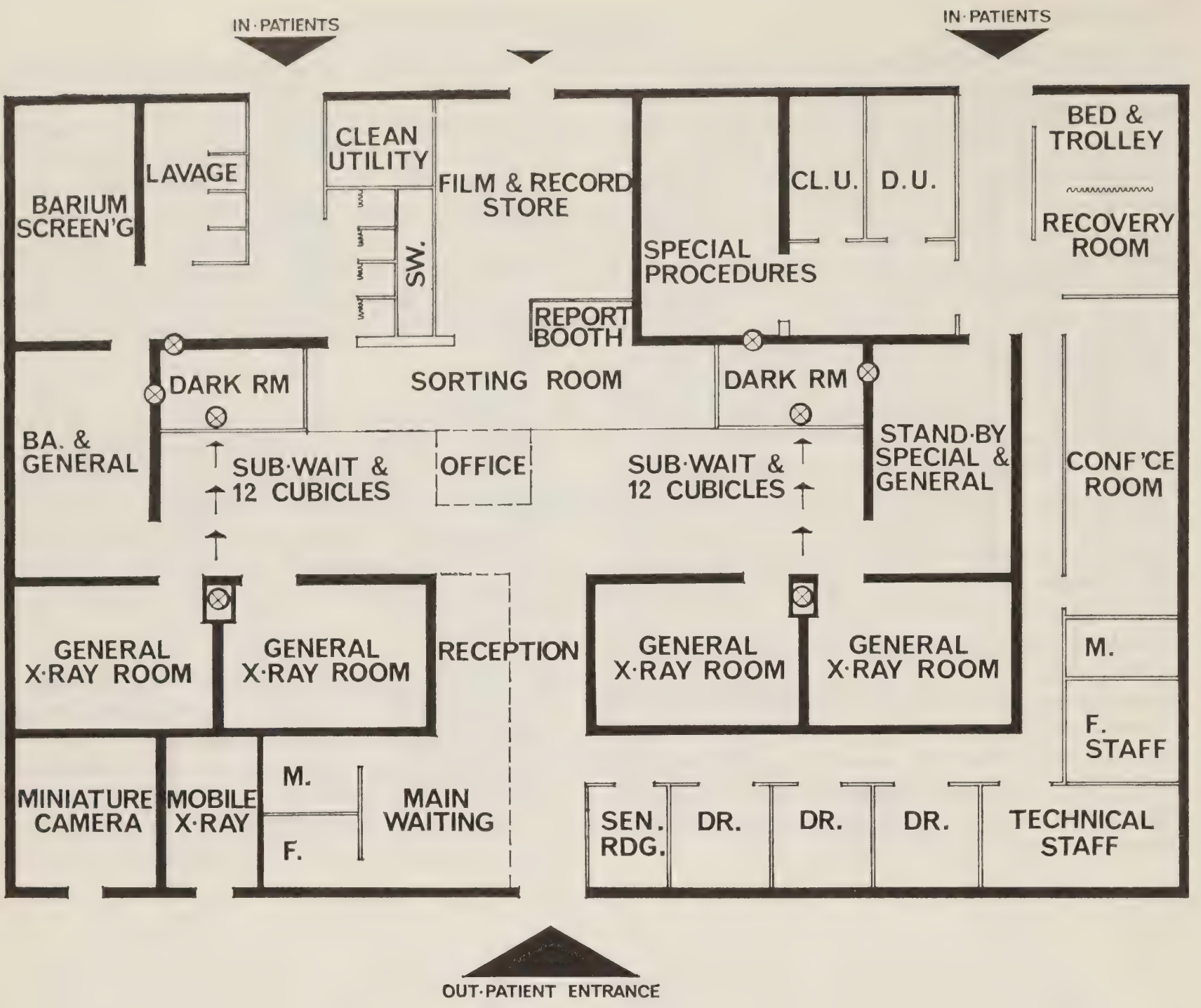

FIGURE 12. Eight-roomed double cluster plan.

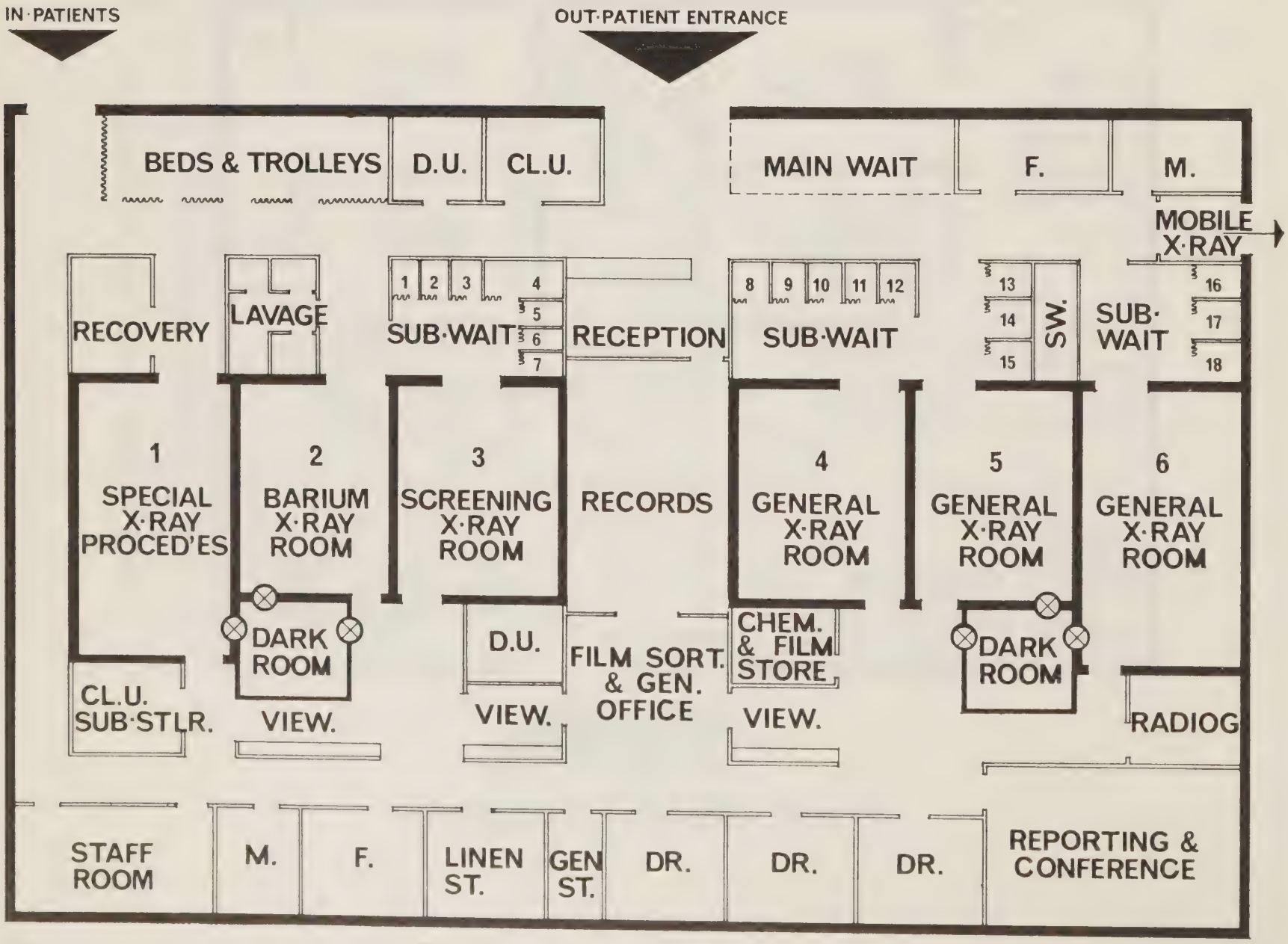

FIGURE 13. Six-roomed sandwich plan.

fluorescent and to enhance the brightness of the final image the sheet of x-ray film is held between two fluorescent screens, the emulsion thus being subjected to the influence of light and x-rays.

23. These screens, which are not unlike sheets of moderately thick tough paper, are held in metal frames known as cassettes. The larger of these, holding 14 in. × 17 in. films, may at present weigh up to about six pounds.

24. Cassettes are loaded with unexposed x-ray film in the safe light of the darkroom or of a dark kiosk in the corner of the x-ray room.

25. The exposed film is then carried, either in the cassette or in a light-tight container to the darkroom for processing. After processing the films are sorted and sent to the radiologist's reporting room. Figure 2 shows the general route for x-ray films.

26. Although automatic processing units obviate much film handling, transportation of films and cassettes has a major effect on the plan form. Careful grouping of radiological rooms in relation to the processing room is essential to keep journeys between them as short as possible.

27. Most radiological procedures are carried out in the radiological department. Some are undertaken in the patient's home, in the wards or in the operating theatre.

The radiological examination

28. The receptionist will direct the patient to one of the x-ray rooms. The examination may be comparatively straightforward and carried out by a radiographer, last no more than a few moments, and take place without the patient having to remove any clothing; it may, on the other hand, be more complicated and require the presence of the radiologist, or in still more complicated procedures, an anaesthetist and other medical staff.

29. The radiographer is the technical expert whose duty it is to position the patient relative to the x-ray film, making the appropriate adjustments to the control apparatus, and finally to make the exposure, and check that a successful film has resulted.

30. The radiologist is a doctor who, in addition to normal experience, has specialised in diagnostic radiology. He determines the type of radiological investigation appropriate to the case and with the evidence provided by that investigation, makes a radiological report. This may be conclusive in itself or form part of all the findings which serve towards making a diagnosis.

Film marking

31. The film must be marked clearly before it is processed so that it can be identified with a particular patient. This may be done in a dark kiosk in a corner of the x-ray room by the radiographer or in the darkroom after the film has been carried there.

Film transportation

32. There are several methods of transporting the film from the diagnostic x-ray room, in which it has been exposed, to the processing unit:

(*a*) The most usual in compactly planned departments is by hand in any of the following ways:

(i) The radiographer takes the cassette to a light-tight kiosk in the x-ray room, unloads it, marks the film and passes it through a light-tight hatch to the darkroom where it is fed into the processing unit.

(ii) As before, but the radiographer passes through the kiosk and feeds the film into the processing unit.

(iii) The radiographer passes the cassette through a light-tight hatch to a darkroom operator who unloads the cassette, marks the film and feeds it into the unit.

(*b*) To solve individual planning problems, particularly in extended linear plans, patent systems of conveyor belts have been installed to save the radiographer leaving the x-ray room, and to link the processing and sorting rooms with the reporting and records filing area.
Systems which are in use are:

(i) Exposed film is removed from its cassette in the dark kiosk in the diagnostic room, marked by the radiographer and:

(1) placed directly on a light-tight static-proof conveyor belt or

(2) placed in a suitable light-tight box which is put on an open conveyor belt.

(ii) The exposed film and its cassette are loaded directly on to the conveyor belt.

Light-tight boxes or reloaded cassettes are placed on the return belt. Whichever type of conveyor is employed, it must be protected against the penetration of stray radiation which can cause film to become fogged.

Film processing

33. Traditionally this has been carried out manually in a processing unit consisting of a series of tanks into each of which the film is placed in turn by hand. There are now several automatic processing units available into which films can be fed at one end from the darkroom and from which they pass at the other end into the light, completely dried and ready in less than ten minutes for scrutiny by the radiologist.

34. New diagnostic x-ray departments of 2 rooms and over are now normally equipped with automatic processing machines. Generally the only x-ray rooms relying on manual processing are the single diagnostic rooms which are sometimes attached to accident and emergency departments, out-patient departments, chest clinics, etc., where these departments are some distance from the main diagnostic x-ray department. It is not normally desirable to have diagnostic x-ray rooms attached to individual departments, as this leads to unnecessary fragmentation of the x-ray facilities, with consequent duplication of staff, services, etc.

35. The number and disposition of automatic processing units depends upon the work-load and layout of the department. A single unit may serve up to 6 rooms but there are advantages in having more than one when servicing or repairs are necessary. Automatic processing units are available with capacity for up to 140 films (14 in. × 17 in.) per hour.

36. The size of film used in diagnostic x-ray work normally varies between, say, 5 in. × 7 in. and 14 in. × 17 in. but facilities may be required for processing the 35 mm., 70 mm. and 100 mm. film used in camera units.

37. Part of the automatic processing unit projects into the darkroom for a distance of 1 ft. 6 in. to 2 ft., the remainder being outside. Storage tanks for chemicals should be placed near the automatic processing unit outside the darkroom.

38. Even where alternative automatic processing units are installed a small manual processing unit must be available for use at night, for special film sizes, or when the machines are being drained down or overhauled. This may also be required by some radiologists (irrespective of the number of automatic units) to satisfy some very urgent cases.

39. At the output end of the automatic unit, space for viewing boxes and film sorting is needed. Most films will be seen almost immediately if only to determine whether the patient may now leave the department or whether further films are needed. A drying unit may be stationed in this space for films which have been processed by hand.

III. List of rooms

A. Basic accommodation

40. The following accommodation should be provided in all cases:

(*a*) *Reception and administration*
- (i) Office, reception and record area
- (ii) Patients' waiting space(s)
- (iii) Patients' sanitary facilities
- (iv) Bed and trolley waiting space

(*b*) *Changing, preparation, etc.*
- (i) Dressing cubicles
- (ii) Lavage (s)
- (iii) W.c's for barium enema patients
- (iv) Patients' recovery room
- (v) Clean utility room
- (vi) Dirty utility/sluice room

(*c*) *Radiodiagnostic rooms*
- (i) Standard diagnostic rooms
- (ii) Miniature camera unit

(*d*) *Film processing, viewing, etc.*
- (i) Darkroom(s)
- (ii) Viewing and film sorting room

(*e*) *Radiologists, technicians and other staff*
- (i) Consultants' room(s)
- (ii) Superintendent radiographers' office
- (iii) Staff cloakrooms and sanitary facilities
- (iv) Staff room for technical staff
- (v) Cleaners' room

(*f*) *Storage*
- (i) General storage
- (ii) Linen
- (iii) Film store
- (iv) Chemical store
- (v) Mobile x-ray store

(*g*) *Plant spaces*
- (i) Plant room
- (ii) Switch room or cupboard

(*h*) *Circulation space necessary for the above accommodation*

(*i*) *Teaching increment* (required in some large district general hospitals and all teaching hospitals).

Radiologists, technicians and other staff
- (i) Demonstration room
- (ii) Library
- (iii) Circulation space

Functional unit

41. The functional unit selected for groups (*a*) to (*h*) of the basic accommodation in this Note and the related cost note (supplied herewith as an addendum to Appendix E to Building Note No. 2) is the radiodiagnostic room, and for group (*i*) it is the teaching increment.

B. Additional accommodation

42. Some accommodation additional to the basic may be required:
- (i) Porter's room
- (ii) Sister's station
- (iii) Facilities for operative radiography
- (iv) Night-call staff room/rest room
- (v) Training school for radiographers
- (vi) Workshop
- (vii) Office space

IV. Description of rooms

43. The Appendix gives a recommended list of areas for the basic accommodation. A comprehensive list of the equipment required in a diagnostic x-ray department is detailed in Hospital Equipment Note No. 6 (Revised). The equipment described in this Note is merely included as a guide in the planning and space requirements and is not intended to be a complete list.

A. Basic accommodation

(a) Reception and administration

(i) *Office, reception and record area*

44. An office for administration and a filing room for storing current x-ray films and records are needed and can be planned either as one space, or treated separately depending on the method of organisation. The reception desk should be adjacent to the office, and command a view of the patients' main waiting space.

45. Except in the case of some casualties, and in-patients, the patient attending for x-ray examination will report at the reception desk, and after necessary documentation will move to the waiting space.

46. *Office.* This is for the receptionist and clerical staff who will be engaged upon clerical duties in connection with records and films. Good natural lighting and ventilation are desirable. The layout will include space for typists' desks and clerical storage such as filing cabinets, card indexes, etc.

47. *Record area.* Current records and records not more than two years old will normally be kept here. Non-current records, which must be kept for at least another four years, should be stored in the central records area.

48. Hospital Equipment Note No. 6 (Revised) gives the length of racking for departments with varying numbers of diagnostic rooms, which in turn determines the floor area of the filing space. The Equipment Note also states that the capacity required on the racks represents the estimated storage for two years' current films in foot length of shelving, a minimum of 18 in. deep and 15 in. high for each shelf, and that ideally current films should be limited to 4 tiers, but to make greater use of space, 6-tier shelving may need to be provided. A small portable stool with a step can be used where the filing clerk cannot reach the top shelf.

The following table shows the comparative areas for either method of storing records:

RECOMMENDED FLOOR AREA OF CURRENT RECORDS STORE

No. of diagnostic rooms	*6-tier shelving*	*4-tier shelving*
4	270 sq. ft.	360 sq. ft.
5	330 sq. ft.	450 sq. ft.
6	400 sq. ft.	530 sq. ft.

(ii) *Patients' waiting space(s)*

49. A main waiting space is needed near the entrance to the department. In addition sub-waiting areas are needed adjacent to dressing cubicles. A total floor area of 15 sq. ft. is recommended for each waiting patient, plus an allowance of 10 sq. ft. for relatives and friends, making in all 25 sq. ft. per patient.

(iii) *Patients' sanitary facilities*

50. These should be provided for both sexes. Each w.c. should be wide enough to admit a wheel-chair and an attendant. Lavatory basins should be provided in the lobbies giving access to the w.c's.

(iv) *Bed and trolley waiting space*

51. This is frequently a recess off the main circulation and should be planned near the radiodiagnostic rooms. It should be designed to accommodate beds or trolleys " end-on ".

(b) Changing, preparation, etc.

(i) *Dressing cubicles*

52. These can be planned as follows: the patient having changed into a dressing gown can wait in the cubicle, or preferably pass to a small sub-waiting area, thus avoiding the need to remain within the close confines of the cubicle. Cubicles should be at least 6 ft. 6 in. high from floor level and fitted with an indicator light to show when they are occupied. Cubicles opening directly into an x-ray room are complex and costly to protect and create a dead space along one wall of the room.

53. It is not necessary to provide natural lighting but cubicles should be well ventilated: an air inlet should be provided. Arrangements are necessary to ensure the security of patients' belongings. A minimum floor area of 15 sq. ft. per cubicle will be needed. Individual x-ray rooms are assumed to require 4 dressing cubicles, although when grouped so that joint use can be made of a bank of cubicles, an average of 3 per x-ray room is adequate. It is an advantage if the sub-waiting area can be fitted with collapsible curtain tracks for extra changing space to be brought into use for special clinics, e.g. chest and orthopaedic clinics, or to provide more space for the patient requiring help in undressing.

(ii) *Lavage*

54. This should be planned close to the radiodiagnostic rooms for those patients requiring an enema before being examined by the radiologist. The room(s) should be provided with a couch, sink and drainer, hosing-down point, cupboard, and space for an instrument trolley.

(iii) *W.c's for barium enema patients*

55. These should be immediately accessible both from the lavage and the radiodiagnostic rooms. They should be easy to clean and have facilities for washing down.

Two w.c's immediately adjoining the dressing cubicles will be required for one radiodiagnostic room in which barium enema examinations are carried out, and three for a group of two such rooms. They should all be fitted with wall-mounted handrails to assist elderly and heavy patients. Care should be taken to ensure that the design of traps and flushing apparatus is suitable for clearing barium from the w.c's.

(iv) *Patients' recovery room*

56. This is required near radiodiagnostic rooms in which special examinations are undertaken. Natural lighting and ventilation are desirable and the room should be designed to accommodate a couch and chairs.

(v) *Clean utility room*

57. This is required for making up trolleys, for dressings and instruments, and barium preparation. Storage space and a basin fitted with wrist-operated taps are needed. Provision should be made for any necessary sterilising to be carried out in this room.

(vi) *Dirty utility/sluice room*

58. Material awaiting disposal can be stored here and bowls and instruments rinsed before they are sent for sterilisation. The room should be equipped with a sink, sluice with bedpan washer and disinfector, shelves, disposal bins and laundry bags, etc. Care should be taken to ensure that the design of traps and waste outlets is suitable for clearing waste barium.

(c) *Radiodiagnostic rooms*

(i) *Standard diagnostic rooms*

59. The minimum clear height should be 10 ft.; where x-ray units require ceiling support or floor tracks these must be provided within this space. Screening rooms, if naturally lighted, require black-out facilities and means to control the entry of sunshine and excessive glare into the room. Mechanical ventilation to supplement natural ventilation is required under these conditions. The artificial lighting should be designed to suit the layout of the x-ray equipment and be adaptable for alternative layouts.

60. Doors should be of suitable size to admit a bed or mobile x-ray unit (see para. 81).

61. The control panel should be protected with either fixed or movable screens. The protective screen should be provided with an observation window of lead glass for the use of the operator who must be able to communicate with the patient.

62. Typical equipment in a radiodiagnostic room is as follows:

high voltage generator unit
control panel and protective screen
tilting table with tube support
cables
vertical chest cassette holder
equipment trolley
storage cupboard
radiologist's stool
x-ray film illuminator
lavatory basin with elbow or wrist action taps
protective clothing/apron rack.

63. 350 sq. ft. is the recommended floor area for general purpose x-ray rooms. A larger room for special procedures, teaching, etc., may be required by some departments. This is referred to in the section on additional accommodation. Depending upon the manner in which films will be conveyed to the darkroom, a dark kiosk (say 4 ft. × 3 ft.) adequately ventilated, may be required within the area. It should contain a small worktop for unloading cassettes, marking films, etc., together with a hatch communicating with the darkroom. Where a conveyor belt is installed access to it from the kiosk must be provided.

(ii) *Miniature camera unit*

64. Such equipment as a miniature film unit should be accommodated in the out-patient department. It is now accepted practice that facilities for chest films should be available for general practitioner referred patients, and for numbers of routine chest films for staff, contacts of tuberculosis cases, etc. This can be provided by establishing a 100 mm. camera unit in one room in the out-patient department, preferably adjacent to the x-ray department. Film development, interpretation, and the storage of record cards, etc. will be within the x-ray department, and in all administrative respects other than reception and access the miniature camera unit is an integral part of the x-ray department. Although physically this room is in the out-patient department for purposes of costing it should be included in the x-ray department accommodation (see Appendix, Table 3). The cost allowance (Appendix E to Hospital Building Note No. 2) takes account of this fact.

65. The room should be about 250 sq. ft. and will accommodate the miniature camera surrounded by suitably protected walls or screens, a control panel, and space for a table at which the necessary cards can be filled in.

(d) *Film processing, viewing, etc.*

66. The processing and viewing area should be grouped with the radiodiagnostic rooms. A light-proof cassette hatch or " pass-box " between each radiodiagnostic room and the darkroom is needed to enable exposed films to be passed to the darkroom and unexposed films to the radiodiagnostic room. [For variations in accommodation where automatic processing is not installed see paragraphs 88–92.]

(i) *Darkroom(s)*

67. This room houses the " loading side " of the automatic processing unit. It should be provided with adequate bench space for unloading cassettes and for removing films from conveyors where these are installed. No chemicals, either in liquid or powdered form, will be

brought in here unless the room also houses the stand-by hand processing unit, in which case it should be fitted out in a similar manner to the darkroom described in paragraphs 90–91. Technical advice should be sought from manufacturers before the selection of materials and finishes is made for this room.

68. Where there are two darkrooms each equipped with automatic processing units in the department, only one darkroom need be equipped for stand-by manual processing. 80 sq. ft. should suffice for a darkroom serving one automatic unit or 120 sq. ft. if manual processing facilities are provided in the same room.

(ii) *Viewing and film sorting room*

69. This is needed to accommodate the bulk of the automatic processing unit. The developed, washed and dried films are delivered by the unit here. A worktop for sorting them and x-ray film illuminators are required. Care should be taken to reduce the effect of noise on staff working for long periods in this area. A reporting kiosk, insulated against some of the sound made by the automatic unit, may also be provided.

70. The proper location and functioning of the viewing and film sorting room in relation to the x-ray rooms and processing area is essential to the whole speed and efficiency of the department. The link with the x-ray film records must be as short as possible as films with reports and past records will be despatched from here.

(e) *Radiologists, technicians and other staff*

(i) *Consultants' room(s)*

71. The room is both a reporting and consulting room, and more than one such room may be required depending upon the size of the department (see Appendix). In addition one large room, of say 400 sq. ft., with several reporting booths for the use of registrars, will be required in larger hospitals, but the size of this may vary according to individual hospital needs.

72. The room should have natural lighting and ventilation; if possible provision should be made for darkening the room when films are being examined. Accommodation should be provided for:

desk
two or three chairs
x-ray film illuminators
cupboard
small worktop
lavatory basin
space for optical viewing apparatus
filing cabinet
space for hanging protective clothing
bookcase.

(ii) *Superintendent radiographer's office*

73. The superintendent radiographer's office should have natural lighting and ventilation and should if possible be conveniently accessible to the screening and viewing and film sorting rooms. Space is needed for a desk, two or three chairs, x-ray viewing panels, a filing cabinet, and bookcase.

(iii) *Staff cloakrooms and sanitary facilities*

74. Cloakrooms with adequate changing facilities and lavatory accommodation should be provided for both male and female staff, bearing in mind that female staff are usually in the majority. This accommodation may be sited so that it is shared with another department. About 8 sq. ft. floor area per person is required for the cloakroom. For every 15 male staff 1 w.c., 1 urinal and 1 lavatory basin should be provided and 1 w.c. and 1 lavatory basin for every 12 female staff.

(iv) *Staff room for technical staff*

75. Natural lighting and ventilation are required in this room which should be equipped with tables and chairs.

(v) *Cleaners' room*

76. A cleaners' room is required with a bucket sink with hot and cold water, drainer and space for mechanical cleaning equipment, cleaning utensils, etc.

(f) *Storage*

(i) *General storage*

77. A store room or cupboard(s) is required for general storage purposes.

(ii) *Linen*

78. Space is needed for day to day linen storage.

(iii) *Film store*

79. This is needed for the storage of unused film. It should be cool and dry, fitted with shelves, and completely shielded from all kinds of radiations.

(iv) *Chemicals store*

80. A store room or cupboard should be provided for chemicals.

(v) *Mobile x-ray store*

81. This is needed for mobile x-ray units. As a guide, the largest size of unit now in use is approximately 4 ft. 6 in. long by 2 ft. 6 in. wide by 6 ft. 4 in. high; doors should be of suitable size. The units may either be stored within the diagnostic x-ray department, or near the wards.

(g) *Plant room and electrical switch room/cupboard*

82. Plant rooms and electrical switch rooms/cupboards can be shared between departments; if, however, this is not practicable, space should be provided within each department as necessary. Where it can be conveniently arranged plant rooms and switch rooms/cupboards may be combined. The area provided must include sufficient space for the servicing and maintenance of plant and equipment.

83. Plant rooms and switch rooms/cupboards should be so sited that they do not interfere with the working of the department; access from the circulation areas of departments should be avoided. The construction should be designed to keep the emission of noise and the transfer of vibration to acceptable limits and natural ventilation should be satisfactory where it is feasible.

(*h*) *Circulation space*

84. Corridors should be at least 7 ft. wide in the clear.

(*i*) *Teaching increment* (required in some large district general hospitals and all teaching hospitals)

Radiologists, technicians and other staff

(i) *Demonstration room*

85. A demonstration room is needed for teaching purposes and staff conferences. It should preferably have natural lighting and ventilation with facilities for blacking-out the room when required. A small raised platform, with chalkboard fixed to the wall, x-ray film illuminators and a slide projector together with a roller screen, are normally required. The total floor area will depend upon the number of persons to be accommodated, but for the purposes of this Note 500 sq. ft. is recommended. This allows for about 25 students and a lecturer.

(ii) *Library*

86. A library may occasionally be provided within the radiodiagnostic department and should preferably adjoin the demonstration room. Shelving or fitted bookcases will be required along one or more sides of the room, together with desks or tables, chairs, etc. A filing cabinet or card indexes will also be needed. The recommended floor area is 200 sq. ft.

(iii) *Circulation space*

87. Additional circulation space will be required for this accommodation.

Variations to the design and fittings within a darkroom where automatic processing is not installed

88. Manual processing is required in one-roomed departments; as a stand-by to an automatic processing unit; for certain very urgent cases; or for processing smaller sized films (e.g. dental x-ray films).

89. Chemicals for film processing will be prepared in the darkroom. Since these are corrosive it is important that floors and walls (to a height of 4 ft. 6 in.) should be finished with an impervious material, resistant to corrosion and staining, which can be easily cleaned.

(i) *Darkroom for hand processing*

90. The darkroom is divided into a " dry " side, and a " wet " side. The cassette hatches from x-ray rooms should deliver directly on to a loading bench on the " dry " side.

91. Provision should normally be made for the following equipment which may be subject to variation, depending on particular requirements:

On the " dry " side—
- loading worktop about 3 ft. high and, say, 2 ft. wide
- film storage cupboard (to avoid constantly going to main film store)
- film hopper for orderly arrangement of current unexposed film with safety switch connected to main lighting—below loading bench or adjacent to it
- waste-paper bin (with slot in bench top over or in door of cupboard under)
- fitted cupboards under worktops
- accommodation for x-ray hangers above loading bench

On the " wet " side—
- processing unit
- pass-through washer to wet-viewing room, fitted with interlocking light-tight lids
- storage for developer and fixing solution
- equipment for recovering silver from used fixing solution
- racks for film hangers
- sink with drainer, and hot and cold taps. Sink wastes and drainage should be designed to accommodate the dumping of large quantities of liquid and of various chemical compositions. The height of the taps should permit the filling of buckets.
- towel dispenser.

(ii) *Viewing room and sorting space combined*

92. The washing process is completed in this room. The following is a list of equipment which is normally needed:
- film washing tank
- roller towel (or towel dispenser)
- x-ray film illuminators
- drying cabinets and hanging space for films (possibly requiring special local ventilation)
- floor and wall finishings similar to those in the darkroom.

B. Additional accommodation

(*i*) *Porter's room*

93. A small room of about 60 sq. ft. is sometimes required for a porter.

(*ii*) *Sister's station*

94. This is sometimes necessary and should be planned directly off the reception area. Natural lighting and ventilation are desirable, and the room should contain a desk, two chairs and a cupboard. The minimum floor area recommended is 100 sq. ft.

(*iii*) *Facilities for operative radiography*

95. In some hospitals facilities are required for combined operative and radiodiagnostic procedures. Much of this work is accomplished with mobile apparatus in the operating theatres, but some takes place in the

radiological room and requires special planning considerations. An x-ray room of 500–600 sq. ft. may be required. This should be planned *en suite* with adequate ancillary accommodation to carry out investigations under aseptic conditions. The siting of this room should be preferably in a cul-de-sac off the main circulation area. The shared use of ancillary accommodation, such as clean and dirty utilities, anaesthetic room, recovery room, scrub-up, etc., is an advantage, but where the load on the room justifies exclusive use of these ancillaries they may be duplicated and a separate darkroom provided. (For information on the provision of anti-static flooring see Hospital Technical Memoranda, Numbers 1 and 2).

(*iv*) *Night-call staff room/rest room*

96. A room for a radiographer on a night-call may be required in the department if no comparable accommodation has already been provided elsewhere, e.g. in the accident and emergency department or the staff residential accommodation. This should contain a lavatory basin, a mirror, divan couch, clothes hanging lockers or wardrobe, a small table with drawers, and a chair. The room may also serve as a staff rest room during the day if required. An area of 90 sq. ft. should be adequate.

(*v*) *Training school for radiographers*

97. Some hospitals will provide facilities for training radiographers. The amount of accommodation required will vary widely according to individual hospital needs. The siting of a training school for radiographers should preferably be as close to the x-ray department as possible, so that practical experience may be acquired concurrently with the academic side of the course. This is particularly important where diagnostic procedures are demonstrated to students within a normal or slightly enlarged x-ray room. The rooms normally required by the students will include the following:

(*a*) common room

(*b*) lecture room(s) } combined in one room in

(*c*) study room/library } smaller schools

(*d*) tutor's room (required in larger schools where a full-time tutor is appointed and sited adjacent to the superintendent radiographer's room)

(*e*) cloak rooms and sanitary facilities for both sexes (these may be planned *en suite* with similar provision for permanent staff).

Training schools for radiographers must be approved by the Radiographers Board as being properly organised and equipped for conducting the training course, or that part of it which is held there.

(*vi*) *Workshop*

98. This is sometimes required where there is equipment which can be more easily maintained on the spot rather than in the hospital central workshop. An area of 60 sq. ft. would be required.

(*vii*) *Office space*

99. If required, in association with reception.

V. Engineering services

100. The engineering services should be designed and installed to ensure minimum interruption of services and disturbance to the working of the department while repairs and maintenance are being carried out.

101. Facilities should be provided for the easy installation of meters should they at any time be required.

102. Fire protection of the building may influence the design of the engineering services, especially ventilation schemes. Due regard should therefore be given to the needs of these requirements in the early stages of planning (see Hospital Design Note No. 2—Protection against Fire).

Mechanical services

Heating and ventilation

103. The radiological department is usually heated from the general hospital central heating system. Mechanical extract ventilation will be necessary for rooms which are darkened for long periods.

104. The following table gives recommended heating design temperatures and ventilation rates, during occupation, based on an outside temperature of 30°F. Where the department is planned so that a mechanical ventilating system becomes necessary, the ventilation rates will require special consideration.

Accommodation	*Temperature*	*Air changes per hour*
Facilities for operative radiography	(See Hospital Building Note No. 26, Operating Department)	
Lavage, patients' changing and standard diagnostic rooms, miniature camera rooms	70°F	2
Darkrooms	65°F	5
Demonstration, study/library, tutor's, clean utility and common rooms, offices, sister's station, patients' recovery, waiting rooms and areas, w.c. compartments, porters' room, workshop, viewing and film sorting rooms	65°F	2
Lecture room	62°F	2*
Equipment and film stores	50°F	½
Records	65°F	1
Corridors, dirty utility room, staff cloakrooms and sanitary facilities, cleaners' rooms	60°F	2

* Augmented by mechanical ventilation when the room is blacked-out. The above temperatures can be reduced to save running costs when the building is unoccupied.

Heating

105. The above conditions are usually met quite adequately by the conventional hot-water radiator heating system, which generally has low installation and maintenance costs. Some specific areas may be warmed with advantage by other forms of heating, such as thermostatically-controlled fan assisted convectors, fitted with filters, in areas where there may be excessive air change due to the frequent opening of outer doors, as in waiting spaces, corridor bays etc. Radiators should normally be placed below windows and against exposed walls to counteract cold air currents, sufficient clear space being allowed beneath to facilitate floor cleaning when machines are used. Care must be taken in their location with respect to benches. Electric radiant heaters may be required over couches. In these instances they should be rigidly wall- or ceiling-mounted clear of maximum couch movement.

106. If ceiling heating systems are used they should conform to the recommendations of the Medical Research Council's Environmental Research Unit which may be found in the *Guide to Current Practice* of the Institution of Heating and Ventilating Engineers.

107. Underfloor heating in standard diagnostic rooms is not recommended because of the following factors: (*a*) there are usually large pipes or ducts under the floor carrying high voltage cables, etc., to x-ray apparatus, apart from the floor tracks and supports for equipment on the floor surface; (*b*) odours can be formed due to spillage on the hot floor surface; and (*c*) supplementary heating is usually required.

108. It is desirable to provide alternative means of heating certain accommodation such as standard diagnostic rooms and patients' changing and waiting rooms, to prevent the temperature falling below a prescribed limit on days when the normal heating system is out of use. Where heating is from a central hot water heating system a separate circuit should be provided so that these rooms can be heated when the general heating system is not in use. Alternatively, fixed thermostatically controlled electric heaters may be economic for summer use.

Ventilation

109. Standard diagnostic rooms should be well ventilated and normally good natural ventilation will suffice, with opening windows when the department is at ground level or above. Particular care should be given to the type of opening window selected; top opening windows at high level should be provided with a " minimum setting " notch or other adjustment to allow air infiltration without draught to lightly clad patients. In ceiling-heated rooms the incoming air should not be directed at the ceiling.

110. Rooms used for screening need to be blacked out for long periods and should be provided with mechanical extract fans placed at low level and discharging to the outside. The external vent should be protected against back pressure and carried clear of the building. Air inlets may be provided at high level, e.g. from the corridor. Louvres should be light-proof.

111. Internal rooms should be mechanically ventilated to suit their individual requirements, internal w.c's should have mechanical extract; air inlet grilles are necessary where the ventilation is extract only.

112. It is desirable to have means of ventilating photographic darkrooms to enable them to be aired occasionally. The rooms should be provided with mechanical extract fans to discharge processing smells direct to the outside air.

113. Small rooms used for cassette or camera loading need not be mechanically ventilated. Suitable cross-ventilation is usually best obtained by placing light-proof inlet louvres at low level behind radiators with the extract fan at high level. The extract fan, which may be a two-speed propeller, must always have suitable cowl protection from the weather and be placed to avoid back pressure from the wind. The cowl should also incorporate suitable light-proof protection.

114. Wet-viewing rooms having drying cabinets should be well ventilated, either naturally by windows having high-level openings, or by mechanical extract fans.

115. Patients' changing cubicles opening directly into the x-ray rooms are difficult to ventilate satisfactorily. Light-proof ventilating grilles at low level to the corridor should be provided in conjunction with a natural ventilation system where possible, as an alternative to systems using extract fans.

116. Sanitary accommodation serving rooms where gastro-intestinal examinations are performed should be well ventilated preferably by windows directly to the outside or alternatively by mechanical extract fans. Simple mechanical extract fans having low-level extract arrangements to the outside should be provided in dirty utility rooms; the external vent should be protected against back pressure and carried clear of the building.

117. Facilities for operative radiography rooms should be dealt with as for operating theatres and will require heating and ventilating arrangements to the standards recommended in the Ministry's Hospital Building Note No. 26, Operating Department, the ventilating system being self-contained for this purpose. These rooms require mechanical ventilation, and a fresh air supply, filtered and warmed to the desired conditions, should be introduced. A filter of 95 per cent efficiency down to 5 microns is satisfactory, but an additional coarse filter is necessary in districts where the air is dirty. Discharge from the room should be by means of a suitably placed low-level grille having a quiet, light-weight flap valve in

the ducting to the outside air; a slightly pressurised condition in the room when the door is closed should be maintained.

118. Demonstration room. With a projector in use for short periods of about one hour, natural ventilation should be sufficient.

Hot and cold water services

119. These will normally be provided by connection to the main service pipes of the hospital to serve lavatory basins, sinks and darkroom requirements, etc. Wrist-action taps having a mixed temperature outlet will normally be required except in lavatories where normal pillar taps should be provided. The hot water circulation system may serve coils in the linen cupboard. For the hot water supplies of small departments it may be more economic to have independent gas or electric water-heaters. The cold water storage should be sufficient for 12-hours' requirement. Drinking water-points taken directly from the service pipes should be provided in the patients' waiting space and w.c. suites. An automatic carton dispenser using disposable cartons may be considered for the patients' waiting space. A hosing-down point with water at a suitable pressure should be provided in the lavage room.

120. Particular care must be taken to ensure that the cold water supply to the darkroom does not exceed 65°F. and that the pressure of the supply to automatic processing machines does not fall below 20 p.s.i. Cold water pipes passing through warm humid rooms at high level should be suitably lagged with a waterproof wrapping to prevent condensation.

Sterilising equipment

121. Normally a central sterile supply department will provide instruments as well as sterile packs for general use.

Town gas

122. This is not usually required but the decision to provide a gas service will depend on local conditions for the installation and cost.

Fire alarms and fire fighting equipment

123. Information on fire alarms and extinguishers is given in B.S. Codes of Practice and in the Ministry's Hospital Technical Memorandum No. 16 on Fire Precautions. Reference should be made to the Ministry's *Code of Practice for the Protection of Persons against Ionising Radiations arising from Medical and Dental use*,* and the forthcoming *Handbook of Radiological Data*,† to be used in conjunction therewith, also to the Ministry's letter dated 2/4/59, " Recommendations of Panel on Fire Hazards with Teletherapy Units on measures to minimise radiation hazards from teletherapy units in the event of fire ". A standard diagnostic room and workshop should have a portable CO_2 extinguisher provided in an easily accessible position. Advice on the fire fighting installation proposed should be sought from the local fire authority.

Electrical installation

General

124. Engineering services in this Building Note and in the associated Cost Note, Appendix E to Hospital Building Note No. 2, do not include the provision or installation of any x-ray apparatus or automatic processing units. The electrical installation will include wiring and equipment for general and special lighting, power, emergency electrical services, socket outlets, heating, ventilating, telephones, clocks and call systems. Normal standards of electrical installation will apply, but for " facilities for operative radiography " the installation should comply with the recommendations contained in Hospital Building Note No. 26, Operating Department.

Supply and distribution

125. Guidance on the supply and distribution arrangements is available in Hospital Technical Memorandum No. 7, Electrical Services—Supply and Distribution. Generally the electrical supply will be provided by a sub-main circuit from the main intake and distribution centre, or by a separate feeder from the main incoming sub-station, to a switch room, centrally placed within the department. The 3-phase, 4-wire, 50 cycles/second feeder to the x-ray department should be as short as practicable to minimise voltage drop.

126. The circuit wiring from the switch room to x-ray machines must be capable of carrying the maximum load without exceeding the voltage drop limit given by the makers of the machines. Ring circuits can be used to supply individual fixed x-ray machines and this enables the maximum economy to be made in the use of conductors. Because of the very short exposure times (usually less than one second) the possibility of exposure times coinciding where apparatus is supplied from the same ring, is remote.

127. Local distribution boards should be situated so as to minimise the length of circuit wiring. They should be installed in well ventilated positions, preferably accessible from corridors and fitted with locks where necessary; it is an advantage if they can be reached from a standing position. H.R.C. type fuses are recommended for general use. Spare ways and fuses should be provided for local extension and space should be allowed for future additions. Conduits and cables should generally be concealed, services ducts being provided wherever practicable; external conduits and fittings should be " weatherproof ". Care should be taken to ensure that conduits and wiring do not penetrate the radiation protection zone(s).

Local control of x-ray apparatus

128. Provision of electrical protective devices and isolation are normally included in the x-ray apparatus.

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* H.M.S.O., price 12s. 6d.

† Radiological Protection Service, Clifton Avenue, Belmont, Sutton, Surrey.

129. A separate additional local isolator or switch fuse will be required as part of the electrical installation and fitted adjacent to the cubicle or entrance door to enable the apparatus to be completely isolated from the mains for servicing, etc.

130. All exposed metal parts of the apparatus should be bonded to the main earth point, e.g. using copper strip at least $\frac{3}{4}$ in. $\times$ $\frac{1}{8}$ in., secured throughout its length.

131. Special cabling from the isolator onwards is preferably carried out by the manufacturers of the x-ray apparatus but it may be carried out by the electrical sub-contractor working to wiring diagrams and layout drawings supplied by the x-ray manufacturers, provided that the performance and guarantee arrangements are satisfactory. Builder's work, etc., in connection with the apparatus must be known at the design stage. Attention should be given in the planning stages to the accommodation; it may be preferable to accommodate the respective generators and transformers in separate cubicles for noise prevention and servicing.

132. The maximum use should be made of wall- and ceiling-mounted trunking, to accommodate wiring. The use of floor ducts in standard diagnostic rooms should be avoided, as far as is practicable. Where underfloor ducts are necessary, they should avoid the x-ray beam areas and the routes should be agreed with the architect and the set manufacturer.

Main voltage outlets for mobile x-ray apparatus

133. 13-amp. socket outlets and ring circuits are suitable for supplying all mobile x-ray apparatus. A special 13-amp. plug is available commercially, which has been designed to accommodate the larger sizes of flexible cables used with mobile x-ray apparatus. It is important, however, that the impedance of the mains up to the 13-amp. socket does not exceed the limit specified by the set manufacturer, otherwise excess voltage drop may occur during exposures.

Typical maximum mains impedance requirements are as follows:

300 mA. sets	0·34 ohms
200 mA. sets	0·6 ohms
100 mA. sets	1·0 ohms

Test have shown that standard distribution arrangements and 7/·029 in. ring circuits will enable impedance readings of less than 0·34 ohms to be obtained in some instances, but values may be in excess of 0·34 ohms where long sub-main or ring wiring is involved. With 240 volt mains and an impedance of 0·1 ohms at the distribution fuse-board all 13-amp. sockets will have an impedance less than 0·34 ohms where 7/·029 in. wiring is used and the length of the ring does not exceed 85 yards or 130 yards where 7/·036 in. wiring is used.

Artificial lighting

Lighting of standard diagnostic rooms

134. The lighting should be designed to suit the size and type of equipment to be installed, to avoid glare, facilitate cleaning and maintenance, and be arranged on two circuits. One circuit should be supplied from the local general lighting distribution board and controlled by wall-mounted switches placed near the door.

135. The other lighting will normally be supplied from a circuit forming part of the control table wiring and controlled by two-way switching from the wall and the control table. This will ensure that lighting will be available when the x-ray apparatus is isolated from the mains for servicing.

136. The choice between tungsten filament and fluorescent lighting will depend on how and where the lamps are used. Fluorescent lighting can be justified where high intensities are required for long periods, e.g. for use in internal rooms which lack natural daylight. Where fluorescent lighting is used, it should be of a type recommended for its colour rendering properties for clinical uses.

137. In rooms to be used for fluoroscopy, it may be necessary for both lighting circuits to be arranged for " dimming ". Suitable control arrangements should be made on or near to the control desk.

Emergency electrical services

138. Guidance on the provision of emergency electrical supplies is given in the Ministry's Hospital Technical Memorandum No. 11, Emergency Electrical Services. A reduced standard of lighting, Grade (*b*), should be provided in the general working area (where portable x-ray machines may be used). Skeleton lighting, grade (*c*), to match reduced standards should be provided in the circulating areas and corridors to enable staff and patients to move about with reasonable safety. Battery operated lanterns may be provided and kept in the reception office for use in areas which have no emergency electrical lighting. Some socket outlets supplied from the emergency electrical services will be required in the standard diagnostic x-ray rooms.

Darkroom lighting

139. "Normal " and " safe " lighting is needed. Both circuits may be controlled by a cord-operated master on/off switch positioned near the door together with a cord-operated change-over switch to give either normal or safe-lighting.

140. A convenient arrangement is for the cord of the change-over switch to run horizontally, above head height, across the room. Alternatively, the " safe " and " normal " lighting may be separately switched by wall-mounted switches fixed at different heights, e.g. at 4 ft. 6 in. and 6 ft. 0 in. respectively to reduce the risk of inadvertently switching on the " normal " lighting.

141. Another door- or drawer-master switch will be required where a drawer or cupboard is provided for cassette loading.

142. Light-lock lobbies, where provided, should be fitted with indicating lights operated from door switches.

143. Where there is no light lock at the entrance to the darkroom, indicating lamps arranged in parallel with the " safe " lights should be provided over the outside of each door giving access to the darkroom.

144. The number and location of " safe " lights will depend on the size of the darkroom, but at least one fitting should be wall-mounted in manual darkrooms to facilitate the viewing of films.

145. The following table gives recommended values of general illumination on the horizontal plane for various rooms:

Accommodation	*Average lumens/sq. ft. at working level*
Facilities for operative radiography	30
Offices, standard diagnostic and record rooms, miniature camera unit, sisters' station, demonstration and tutor's room, lecture room, study room/library and workshop	20
Clean utility room	15
Dirty utility room, lavage, viewing and film sorting, patients' recovery and staff rooms, waiting space, porters' and common room	10
Dressing cubicles, enquiries, staff cloakrooms, and sanitary facilities, storage, cleaners' rooms ..	7
Corridors	7*
Darkrooms (white lighting) ..	5

* The standard is given at floor level.

146. Film store lighting and the lighting in dressing cubicles and any other rooms which open directly into x-ray rooms used for fluoroscopy should be controlled by door-operated switches.

Socket outlets

147. Sufficient general purpose 13 amp. switched shuttered outlets on ring or spur circuits should be provided to allow all appliances which are likely to be used at one time to be connected to a separate outlet.

148. Other types of sockets should only be provided where there are special reasons. The provision of 3-phase outlets is not recommended.

149. Special care must be taken in the positions selected for socket outlets on the " wet " side of the darkroom, to ensure electrical safety.

150. The following socket outlet distribution is suggested:

Standard diagnostic rooms	Two twin outlets for general purposes arranged on separate circuits plus 13 amp. outlet for mobile x-ray apparatus with larger circuit wiring where necessary (see paragraph 133).
Mobile x-ray store	One for general purposes plus an outlet for x-ray apparatus (if required).
Darkrooms	Two twin outlets plus two single outlets (may be varied according to room size).
Viewing and film sorting	One for each drying cabinet plus one twin outlet for general purposes.
Reporting rooms	One twin outlet.
Offices (Superintendent radiographer, consultants)	One twin outlet plus additional sockets for viewing screens.
Miniature camera unit, sister's station, staff room	One twin outlet.
Demonstration room	Two twin outlets for platform and use of projector.
Common room, study room/library	One twin outlet.
Lecture room	Two twin outlets for projector and lecturer's rostrum.
Workshop	Two twin outlets (to suit layout)
Clean utility room	One for general use.
Electrical switch and distribution room	One outlet for general use.
Corridors, waiting spaces, etc.	Socket outlets to be provided for the convenient use of domestic appliances.

151. Fixed apparatus such as automatic processing units and wet-viewing screens should be connected to the mains by permanently installed wiring.

Telephone and call system

152. Telephone facilities for internal and external calls will form part of the hospital telephone system and will normally be provided in the reception office, consultant's office, superintendent radiographer's room, porters' room, sister's station, night call staff room. In large and busy departments a loud-speaking telephone system between reception desk and x-ray rooms and offices has advantages.

153. In smaller departments P.A.B.X. (Private Automatic Branch Exchange) extensions will probably be adequate.

154. Buzzer warning systems for calling patients and porters are generally unsatisfactory, but a bell-push and bell may be required at the reception desk.

Electric clocks

155. Electric clocks will normally be required in the reception office, standard diagnostic rooms, consultants' room, superintendent radiographer's office, demonstration room, sister's station, facilities for operative radiography and lecture room. Clocks in standard diagnostic rooms and rooms providing facilities for operative radiography, may be synchronous type with a sweep second pointer. Where an impulse clock system exists, it should be extended to these areas, using muted slave clocks with a sweep second pointer.

Staff location system

156. The hospital staff location system should be extended to the x-ray department reception desk.

Earthing

157. An "earth" system, using copper tapes, should be provided in the workshop for testing purposes.

APPENDIX

TABLE 1

A. Basic accommodation	*Number of radiodiagnostic rooms*				
(*a*) *Reception and administration*	4	5	6	7	8
Type of room	*Areas (sq. ft.), etc.*				
(i) Office and reception	120	180	180	180	180
Record area*	270	330	400	460	540
(ii) Patients' waiting space(s):					
Main	125	150	175	200	225
Subsidiary	125	150	175	200	225
(iii) Patients sanitary facilities — Male	1 w.c. and 1 lav. basin	1 w.c. and 1 lav. basin	1 w.c. and 1 lav. basin	1 w.c., 1 urinal and 1 lav. basin	1 w.c., 1 urinal and 1 lav. basin
(iii) Patients sanitary facilities — Female	1 w.c. and 1 lav. basin	1 w.c. and 1 lav. basin	1 w.c. and 1 lav. basin	1 w.c. and 1 lav. basin	1 w.c. and 1 lav. basin
(iv) Bed and trolley space	150	150	150	200	200

* Calculated on the basis of 6-tier shelving.

TABLE 2

A. Basic accommodation		*Number of radiodiagnostic rooms*				
(*b*) *Changing, preparation, etc.*		4	5	6	7	8
Type of room	*Minimum individual room size (sq. ft.)*	*Number of rooms*				
(i) Dressing cubicles	15	12	16	18	22	24
(ii) Lavage	80	1	1	1	2	2
(iii) W.c's for barium enema patients	20	2	2	3	3	3
(iv) Patients' recovery room ..	100	1	1	1	2	2
(v) Clean utility room	120	1	1	1	2	2
(vi) Dirty utility room	80	1	1	1	2	2

APPENDIX

TABLE 3

A. Basic accommodation (*c*) *Radiodiagnostic rooms*	*Average individual room size (sq. ft.)*	*Number of rooms*				
(i) Standard diagnostic rooms ..	350	4	5	6	7	8
(ii) Miniature camera unit	250	1	1	1	1	1

TABLE 4

A. Basic accommodation (*d*) *Film processing, viewing, etc.*		*Number of radiodiagnostic rooms*				
		4	5	6	7	8
Type of room	*Minimum individual room size (sq. ft.)*	*Number of rooms*				
(i) Darkroom for automatic processing unit	80 *	—	1	1	1	1
	120	1	1	1	1	1
(ii) Viewing and film sorting room ..	125	1	2	2	2	2

* 80 sq. ft. only, if no manual processing facilities provided.

TABLE 5

A. Basic accommodation (*e*) *Radiologists, technicians and other staff*		*Number of radiodiagnostic rooms*				
		4	5	6	7	8
Type of room	*Minimum individual room size (sq. ft.)*	*Number of rooms/area (sq. ft.), etc.*				
(i) Consultant's room(s)	120	2	2	3	3	3
Reporting and conference room for large departments ..	400	—	—	1	1	1
(ii) Superintendent radiographer's office	100	1	1	1	1	1
(iii) Staff cloakrooms and sanitary facilities:						
Male	*Cloakroom* 8 sq. ft. per person plus	1 w.c., 1 urinal, 1 lav. basin for every 15 staff members on duty at peak periods				
Female	*Cloakroom* 8 sq. ft. per person plus	1 w.c., 1 lav. basin for every 12 staff members on duty at peak periods				
(iv) Staff room for technical staff ..	150/200	1 (150 sq. ft.)	1 (150 sq. ft.)	1 (200 sq. ft.)	1 (200 sq. ft.)	1 (200 sq. ft.)
(v) Cleaners' room	50	1	1	1	1	1

APPENDIX

TABLE 6

A. Basic accommodation *(f) Storage*		*Number of radiodiagnostic rooms*				
		4	5	6	7	8
Type of room	*Minimum individual room size (sq. ft.)*	*Number of rooms/area (sq. ft.), etc.*				
(i) General storage	25/50	1 (25 sq. ft.)	1 (50 sq. ft.)	1 (50 sq. ft.)	1 (50 sq. ft.)	1 (50 sq. ft.)
(ii) Linen	60	1	2	2	2	2
(iii) Film store	25/40	1 (25 sq. ft.)	1 (25 sq. ft.)	1 (25 sq. ft.)	1 (40 sq. ft.)	1 (40 sq. ft.)
(iv) Chemicals store	25/40	1 (25 sq. ft.)	1 (25 sq. ft.)	1 (25 sq. ft.)	1 (40 sq. ft.)	1 (40 sq. ft.)
(v) Mobile x-ray store	50	1	1	1	1	1

TABLE 7

A. Basic accommodation *(g) Plant room/switch room*		*Number of radiodiagnostic rooms*				
		4	5	6	7	8
Type of room	*Minimum individual room size (sq. ft.)*	*Number of rooms/area (sq. ft.), etc.*				
(i) Plant room	100/150	1 (100 sq. ft.)	1 (100 sq. ft.)	1 (100 sq. ft.)	1 (150 sq. ft.)	1 (150 sq. ft.)
(ii) Switch room/cupboard	40/50	1 (40 sq. ft.)	1 (50 sq. ft.)	1 (50 sq. ft.)	1 (50 sq. ft.)	1 (50 sq. ft.)

TABLE 8

A. Basic accommodation
(i) Teaching increment

Type of room	*Minimum individual room size (sq. ft.)*
(i) Demonstration room ..	500
(ii) Library	200

Hospital Building Note No. 2

Appendix E

Diagnostic X-Ray Department

Hospital Building Note No. 6 (Revised 1968)

The scales of accommodation and related costing are applicable to diagnostic x-ray departments in district general and teaching hospitals containing not less than four nor more than eight radiodiagnostic rooms.

The costing is based on the assumption that the processing of films is carried out by an automatic processing unit whilst facilities for manual processing are available as stand-by.

A. Basic accommodation

(*a*) *Reception and administration*

(i) Office, reception and record area
(ii) Patients' waiting space(s)
(iii) Patients' sanitary facilities
(iv) Bed and trolley waiting space

(*b*) *Changing, preparation, etc.*

(i) Dressing cubicles
(ii) Lavage(s)
(iii) W.c's for barium enema patients
(iv) Patients' recovery room
(v) Clean utility room
(vi) Dirty utility/sluice room

(*c*) *Radiodiagnostic rooms*

(i) Standard diagnostic rooms
(ii) Miniature camera unit

(*d*) *Film processing, viewing, etc.*

(i) Darkroom(s)
(ii) Viewing and film sorting room

(*e*) *Radiologists, technicians and other staff*

(i) Consultants' room(s)
(ii) Superintendent radiographer's office
(iii) Staff cloakrooms and sanitary facilities
(iv) Staff room for technical staff
(v) Cleaners' room

(*f*) *Storage*

(i) General storage
(ii) Linen
(iii) Film store
(iv) Chemicals store
(v) Mobile x-ray store

(*g*) *Plant spaces*

(i) Plant room(s)
(ii) Switch room(s)

(*h*) *Circulation space necessary for the above accommodation.*

(*i*) *Teaching increment* (required in some large district general hospitals and all teaching hospitals).

Radiologists, technicians and other staff

(i) Demonstration room
(ii) Library
(iii) Circulation space

B. Additional accommodation

(i) Porters' room
(ii) Sister's station
(iii) Facilities for operative radiography
(iv) Night-call staff room/rest room
(v) Training school for radiographers
(vi) Workshop
(vii) Office space

Circulation space

For the purpose of the provisional cost limit the area occupied by internal circulation space and internal walls and partitions represents, on average, an addition of 45 per cent to the net floor area of the basic and additional accommodation.

DEPARTMENTAL COST ALLOWANCES

For cost control purposes the lump sum Cost Guide Figure for the various functional units shown in the Departmental Cost and Area Guide (Hospital Building Procedure Note No. 6) will be applicable.

The Basic and Additional accommodation costs used in determining these figures are as follows:

1. Basic accommodation

Functional unit—a radiodiagnostic room.

The formula is expressed in terms of the radiodiagnostic rooms included in the department.

	£
For four radiodiagnostic rooms ..	46,000
For five radiodiagnostic rooms ..	54,500
For six radiodiagnostic rooms ..	64,750
For seven radiodiagnostic rooms ..	75,000
For eight radiodiagnostic rooms ..	80,000
For teaching increment (if required) ..	5,200

2. Additional accommodation

	Per sq. ft. £ s. d.
Sister's room or office space	5 3 0
Training school for radiographers ..	5 9 0
Porters' room	5 13 0
Night-call staff room	5 19 0
Workshop	6 15 0

Operative radiography

Due to the variability of accommodation which may be required under this head it is considered inappropriate to formulate specific rates for these facilities. Where this type of accommodation is required *ad hoc* rates based on the cost allowances set out in Hospital Building Note No. 26 should be utilised.

NOTES

(i) The cost allowances in this Appendix are based, as far as possible, on the price level of other current departmental cost allowances.

(ii) The cost of any special accommodation or facilities outside the scope of this Appendix is to be individually assessed pending the publication of specific cost allowances for these items.

(iii) ENGINEERING. The following engineering services are included in (1) and (2) above and account for approximately:

20 per cent of total cost of Basic accommodation and 9–17 per cent of Additional accommodation.

(*a*) *Mechanical services*

Heating—Low pressure hot-water radiator system supplemented by electric fan convectors and radiant heaters (summer use).

Ventilation—Mechanical extract fan from darkrooms, radiodiagnostic rooms, internal rooms and lecture rooms.

Hot and cold water including drinking water and fire-fighting supplies.

Mechanical equipment includes:

Bedpan washer—one in 4, 5 and 6 room Departments, two in 7 and 8 room Departments.

Pass through washer—one in 4 and 5 room Departments, two in 6, 7 and 8 room Departments.

Fire-fighting equipment.

(*b*) *Electrical services*

Lighting (including fittings), socket outlets, clocks, telephones, fire alarms, all equipment wiring, fixed x-ray screens, staff location wiring, emergency lighting (excluding primary supply equipment) and departmental submains and switch gear.

Electrical equipment includes—radiant heaters, fixed x-ray screens, safelights.

(*c*) Automatic film processing units and portable equipment in darkrooms, x-ray machines and apparatus are *excluded*—see EQUIPMENT NOTE No. 6 (revised) for details of equipment.

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Hospital Building Notes

1	Buildings for the hospital service	out of print
2	The cost of hospital buildings	out of print
3	The district general hospital	out of print
4	Ward units (revised 1968)	27½p (32p)
5	Short stay psychiatric unit	out of print
6	Diagnostic X-ray department (revised 1968)	31p (33½p)
7	Accommodation for nursing staff	superseded by No. 24
8	Physiotherapy department	out of print
9	Occupational therapy department	out of print
10	Kitchens	12½p (15p)
11	Dining rooms	10p (12½p)
12	Out-patient department	7½p (10p)
13	Central sterile supply department	temporarily out of print
14	Training school for nurses	out of print
15	Pathology department	out of print
16	Boiler house and steam boiler plant	out of print
17	Deep plan (race track) ward units	out of print
18	Administrative department	17½p (20p)
19	Department of medical photography and medical illustration	14p (16½p)
20	Mortuary and post-mortem room	12½p (15p)
21	Maternity department	out of print
22	Accident and emergency department	30p (34½p)
23	Children's ward	12½p (15p)
24	Residential accommodation for staff	12½p (15p)
25	Laundry	25p (29½p)
26	Operating department	42½p (47p)
27	Intensive therapy unit	16p (18½p)
28	Dental department of the out-patient department	15p (17½p)
30	Accommodation for psychiatric patients	out of print
31	Psychiatric ward (type 1)	12½p (15p)
32	Psychiatric ward (type 2) and pre-discharge (hostel type) ward	25p (27½p)
33	Rehabilitation centre of psychiatric patients	17p (13½p)

Hospital Equipment Notes

1	Equipping a hospital building	6p (8½p)
4	Ward units	31p (33½p)
6	Diagnostic X-ray department	17½p (20½p)
7	Accommodation for nursing staff	superseded by No. 24
8	Physiotherapy department	17½p (22p)
9	Occupational therapy department	20p (24½p)
10	Kitchens	17½p (20p)
11	Dining rooms	10p (12½p)
12	Out-patient department	25p (29½p)
14	Training school for nurses	15p (17½p)
15	Pathology department	25p (29½p)
16	Boiler house and steam boiler plant	7½p (10p)
18	Administrative department	32½p (37p)
19	Department of medical photography and medical illustration	12½p (15p)
20	Mortuary and post-mortem room	15p (17½p)
21	Maternity department	72½p (79p)
22	Accident and emergency department	42½p (47p)
23	Children's ward	17½p (22p)
24	Residential accommodation for staff	29p (33½p)
25	Laundry	temporarily out of print
28	Dental department of the out-patient department	30p (32½p)
31	Psychiatric ward (type 1)	16p (18½p)
32	Psychiatric ward (type 2) and pre-discharge (hostel type) ward	30p (32½p)

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